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INCOMPATIBILITY

—IN PRESCRIPTIONS—

S. K. MUKHERJI

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—IN PRESCRIPTIONS—

BY

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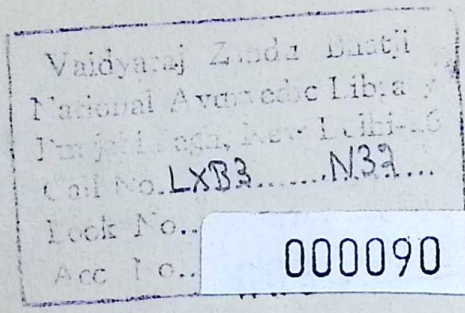

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PREFACE TO THE NEW EDITION

That this book has proved of value to students and practitioners is demonstrated by the fact that a third edition has been necessary within a few years. It has also been adopted as a text book in most of the medical schools and colleges in India.

This edition has been carefully and completely revised and brought up to date. Much new matter has been added, and in many respects it represents a totally new book.

It is hoped that the book will continue to be useful to the medical students, practitioners and dispensers for whom it is intended.

44, BADUR BAGAN STREET,
CALCUTTA.
15th January, 1932.

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PREFACE

The knowledge of incompatibility is essential for the useful and safe combination of drugs in a prescription. But unfortunately this important subject is neglected in the medical curriculum with the result that a young medical man fresh from the college is generally afraid of writing his own prescriptions. This work is intended to be a guide to medical men in prescribing without falling into any of the pitfalls.

The subject is equally important to the dispensers as in the case of a doctor's mistake they are expected to detect it. The responsibility of a dispenser is the same as that of the doctor, and in case of death or physical injury caused by wrong combination of drugs both the doctor and the dispenser are held liable.

Incompatibility in prescriptions is regarded by the students as a dry subject to be committed to memory. In this work an attempt has been made to present the subject in a clear and lucid way with the help of examples and to make it as interesting as possible. The subject matter has been arranged in such a way as to help the students in grasping it intelligently without taxing his memory. The chapter on general principles gives a survey of the whole subject ; while the second chapter deals with the incompatibles of individual drugs commonly in use. The table of incompatibilities will be of help to busy practitioners and dispensers, and a detailed index at the end of the book will make reference easy. The chapter on exercises is meant for students and it is hoped that solution of these problems will be interesting to them.

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INCOMPATIBILITY IN PRESCRIPTIONS

GENERAL PRINCIPLES

Any undesirable modification in a prescription which interferes with its elegance, usefulness or safety is called incompatibility ; and such a combination is known as an incompatible prescription. A knowledge of incompatibility is essential for the safe combination of drugs in a prescription.

Before presenting the incompatibility of individual drugs, it is intended to study the general principles underlying these changes. It will help the readers to have a clear idea of the subject.

Incompatibility may be :—

I *Physical or pharmaceutical.*—This happens when the mixture does not form a clear solution.

II *Chemical.*—When a chemical reaction takes place between the different ingredients in a prescription.

III *Physiological or therapeutic.*—When the different ingredients in a prescription counteract each other's action.

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PHYSICAL OR PHARMACEUTICAL INCOMPATIBILITY

A mixture does not form a clear solution when :—

(1) it is insoluble in the solvent used ;

(2) there is deficiency in solvent ;

(3) the drugs which are prescribed do not mix with each other ; and

(4) a liquid is formed on mixing two solids.

I Insoluble Salts.—

The separation of insoluble substances from solution at ordinary temperature is the commonest example of physical incompatibility. The following solvents are ordinarily used for dissolving salts and other substances in mixture.

Common Solvents	Used for dissolving
(a) Water	Mineral salts
(b) Alcohol	Resinous substances and essential oils.
(c) Glycerine	Same as above.
(d) Fixed oils, ether and chloroform	Special substances.

We shall now study the solubility of substances in different solvents.

(a) Substances insoluble in water.—Water is the solvent most commonly used in a prescription and it is therefore important that the student should know the substances which are not soluble in water.

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Substances soluble in water	Substances insoluble in water
1. Most salts of alkali radicals (e. g. sodium, potassium, and ammonium) ; borax (1 : 25)	1. Arsenites (except those of alkalies).
2. Chlorides (except silver chloride and mercurous chloride or calomel).	2. Chlorides of silver and mercurous chloride or calomel.
3. Iodides (except iodides of mercury, lead and bismuth.)	3. Iodides of mercury, lead and bismuth ; iodoform, iodine (practically.)
4. Bromides.	4. Oxides and hydroxides (except those of alkalies).
5. Hypophosphites of the metals (except ferric hypophosphite).	5. Sulphides ,,
6. Nitrites.	6. Arsenates ,,
7. Acetates (except quinine, silver and mercurous acetate).	7. Carbonates ,,
8. Chlorates.	8. Phosphates ,,
9. Nitrates (except bismuth subnitrate).	9. Ferric hypophosphite (almost).
10. Permanganate of potassium (1 : 20).	10. Salicylate and subnitrate of bismuth.
11. Sulphates (except those of barium, strontium and lead) e.g. copper sulphate (1 : 3. 5.)	11. Sulphates of alkaline earths (i. e. barium, strontium and lithium).
12. Tartrate of antimony (1 : 17).	
13. Organic silver compounds e. g. argyrol, protargol etc.	12. Acid Benzoic (1 : 450) ; picric (1 : 90).
14. Acids—Boric (1 : 30), Carbolic (1 : 10), tannic, chromic, etc.	
15. Salts of alkaloids (generally), e. g. morphine acetate (1 : 2·5), hydrochloride (1 : 25), tartrate (1 : 11) ; strychnine hydrochloride (1 : 60) ; heroin hydrochloride (1 : 3), caffein citrate (1 : 32) etc.	13. Alkaloids (basic) e. g. caffein (1 : 80).
	14. Most synthetic hypnotics e. g. phenacetin, acetanilide (1 : 210, boiling water 1 : 18), aspirin (1 : 300), camphor, menthol (very slightly soluble).
16. Phenazone, chloral hydrate etc.	15. Fats, resins, oleoresins, hydrocarbons and vegetable oils.
17. Gum arabic.	

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Prescriptions should, wherever possible, be made up with distilled water; but ordinarily tap water is used in cases where distilled water is not mentioned. But the disadvantage of tap water is that it is in some places hard and contains calcium and magnesium salts and sulphates; in such cases there may therefore be slight precipitation of phosphates, carbonates, etc.

For example,—

(i) Ferrum tartaratum produces a muddy colour with tap water; while distilled water makes a clear solution.

(ii) Mercuric chloride precipitates an insoluble mercuric salt when dissolved in tap water.

(iii) Liquor arsenicalis produces a precipitate of calcium carbonate with tap water.

(iv) Tincture cardamom co. gives a brilliant crimson colour with tap water; while a reddish brown colour is produced with distilled water.

(v) Tinct. lavandulæ co. produces a muddy mixture with tap water; but a bright one with distilled water.

(b) Substances insoluble in alcohol.—

Alcohol dissolves organic substances more readily than water; but gums and albuminous substances which are soluble in water are insoluble in it. Inorganic salts are very sparingly soluble in alcohol and the presence of alcohol in any form is liable to throw them out of the solution. For example, potassium chlorate crystallises out very readily in the presence of alcohol.

Re

Mag. Sulphas	...	ʒiv
Spt. Aetheris nitrosi	...	ʒi
Aquam ...	...	ad ʒi

This mixture becomes solid after a few minutes.

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Drugs soluble in alcohol	Drugs insoluble in alcohol.
Organic substances. Hexamin (1 : 8). Salol. Substances of alcoholic series e. g. chloroform, iodoform (1 : 100) and paraffin. Volatile oil. Castor oil and croton oil. Fats. Resins. Acid benzoic (1 : 3), carbolic, salicylic (1 : 3·5), picric (1 : 10). Menthol, camphor (1 : 1. 25), thymol. Methyl Salicylate. Aspirin (1 : 5), acetanilide (1 : 4·2), chloral hydrate, phenacetin (1: 21), phenazone. Alkaloids e. g. caffein (1 : 40). Most acetates (except quinine, silver and mercurous acetates), benzoates, nitrates, salicylates, chlorides, bromides and iodides. Creosote. Resorcin.	Inorganic substances e. g. metallic nitrates, phosphates, salicylates tartrates etc. Carbonates. Gums e. g. mucilage of acacia should not be given with any strong tincture (but may be used as a suspending agent when a resinous tincture is contained in an aqueous mixture). Albuminous substances.

(*c*) *Substances insoluble in chloroform.*—

Chloroform dissolves all substances which are soluble in alcohol *e. g.* camphor, chloral hydrate (1 : 3), menthol, phenazone, creosote, acid benzoic (1 : 7), iodoform etc. Camphor is dissolved in chloroform as an application in toothache.

[Chloroform is freely soluble in alcohol and also in water to some extent (1 : 200).]

(*d*) *Substances insoluble in glycerine.*—

The solvent power of glycerine lies between water and alcohol, with both of which it mixes well. It is a useful solvent for tannic acid, carbolic acid and alum. It also

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dissolves acetanilide, chloramine T (1 : 7), copper sulphate, creosote, resorcin etc.

Carbolic acid is soluble in about 12 parts of water; when stronger solutions are required glycerine should be used to dissolve it,

Fixed oils are not soluble in glycerine.

Borax is dissolved in glycerine (1:1) in glycerine of borax, but it is decomposed by glycerine forming boric acid and glyceryl borate.

(e) *Fixed oils as solvents.*—

Olive oil is a good solvent of camphor (1:4), chloral hydrate, menthol, resorcin, iodoform (1 : 30) etc, and is specially used for application as a spray.

Liquid paraffin is also a good solvent for camphor etc., and used in solutions for spray.

Castor oil is a useful solvent for basic alkaloids e.g. atropine, homatropine, cocaine, eserine etc., for instillation into the eye (strength 0·5 to 2 per cent.). When so dissolved the drug is not washed away with the tears. It must be remembered however that the salts of alkaloids are insoluble in castor oil and only the basic salts can be dissolved in it.

(f) *Ether as a solvent.*—Ether dissolves alkaloids, acid benzoic (1 : 2·5), chloral hydrate, creosote, fats, iodine, menthol, iodoform, resins, resorcin etc., but is rarely used as a solvent.

[Ether is soluble 1 in 10 of water and also in alcohol.]

(g) *Substances which help the solution of certain drugs.*—

Thus iodine is very sparingly soluble in water, but potassium iodide helps solution.

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Another example is lime water. Lime (calcium hydroxide) is sparingly soluble in water ; but its solution is aided by the addition of sugar, as in liquor calcis saccharatus.

II. Deficiency in Solvent.—

A precipitate takes place when the solvent is not enough to dissolve the salts or other ingredients in a prescription. Thus—

(i) Re

Potass chloras	...	... ℥i
Aquam	...	... ad ℥vi

In this prescription the amount of water is not sufficient to dissolve the salt. Potass. chlorate requires 16 parts of water for solution.

(ii) Re

Acid. carbolic	...	... ℥i
Aquam	...	... ad ℥vi

Carbolic acid requires 12 parts of water for solution ; so in this case the amount of water is not sufficient for the purpose. The carbolic acid will be separated and lie as a layer at the bottom of the lotion. It is therefore a dangerous prescription. The usual strength of carbolic lotion is 3 per cent.

III. Drugs which do not Mix with Each Other,—

(a) *Oils.—*

Oils generally mix with one another, but castor oil and liquid paraffin when given in a mixture soon separate into layers.

Oils also do not mix with glycerine, although the latter is the organic base of fixed oils (fats.)

These are not soluble in water and should be prescribed as emulsions.

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(b) *Carbolic Acid*—

When carbolic acid is mixed with collodion a gelatinous mass is produced.

Re

Acid. carbolic	...	...	ʒii
Collodion flexile	...	...	ad ʒi

A solid gelatinous mass is formed.

IV. Formation of a Liquid by the Union of Two Salts.—

Sometimes when two or more solids are mixed together the result is the formation of a liquid or semiliquid substance. These cases fall under two groups :—

(a) *Formation of molecular complexes as a result of trituration.—*

These are unstable liquids or pasty mixtures easily resolved into their components. The probable explanation is the mutual lowering of the melting point of the components of the powder.

Examples :—

Salt	When mixed with	Result of Mixing
Acetanilide ...	Salicylic Acid	A pasty mass.
Camphor ...	Chloral hydrate	A liquid is formed and there is separation of the camphor which floats on the top as a soft white solid.
,, ...	Menthol ...	
,, ...	Carbolic Acid ...	
Chloral hydrate ...	Sulphonal ...	A soft pasty mass.
Hexamine ...	Aspirin ...	A pasty mass.
Phenacetin ...	Salicylic Acid ...	A pasty mass.
Phenazone (antipyrine) ...	Sodii salicylate	Liquefy when mixed together in powder form.
Salol ...	Antipyrine ...	Liquefy in hot weather.
,, ...	Camphor ...	Liquefy at ordinary temperature.
,, ...	Chloral hydrate ...	
,, ...	Guaiacol ...	
,, ...	Menthol ...	

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Sometimes the combination of three substances in a powder is necessary to produce a pasty mass or liquefaction.

Antipyrine + phenacetin + acetanilide = a pasty mass is produced.

(b) *Withdrawal of water of crystallisation from one substance in a powder by another.*—

In such cases the powder dissolves in the water thus abstracted, as a result of which it becomes pasty or liquefies. This happens when a drug, which is very soluble in water, is mixed with one containing water of crystallisation.

Examples :—

Drug	When mixed with	Result
Lead acetate ...	Alum ...	The powder becomes moist when triturated due to liberation of some water of crystallisation.
,,	Zinc sulphate ...	
Sodii sulphate	Pot. citrate ...	Semi-solid mass is formed due to liberation of water of crystallisation.
Tartaric acid ...	Glauber's salt ...	A pasty mass is formed due to liberation of water of crystallisation.
,, ...	Borax ...	Do

Prevention of Physical Incompatibility.—

It is possible to remedy or in some cases even to prevent the physical incompatibility by—

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(a) paying attention to the order of mixing the ingredients in the prescription.

(b) selection of proper solvent.

(c) the use of a protective agent (e.g. gum) to emulsify or suspend the insoluble drug.

When a drug is to be given in a vehicle in which it is insoluble, it may be suspended in water by suitable means. By means of a suitable emulsifying agent, the ingredients are broken up into the minutest particles, which are perfectly coated with gum or other vehicle and consequently float uniformly in the vehicle. Fats, resins, oleoresins, hydrocarbons and volatile oils which are almost insoluble in water are thus prescribed as emulsions.

For example—

Re

Ol. ricini	...	...	℥vi
Aq. chlorof.	...	...	ad ℥vi

Castor oil being insoluble in water separates from the mixture. It may however be served as follows :—

Re

Ol. ricini	...	...	℥vi
Muc. acacia	...	...	℥vi
Aq. chlorof.	...	...	℥vi

In this way the oil is broken up into the minutest particles, which then float uniformly in the water.

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CHEMICAL INCOMPATIBILITY

Chemical incompatibility is the chemical reaction occurring between the ingredients of a prescription. It may be either :—

(1) *Homogeneous.*—That is when no visible change is observed, such as production of gas or precipitate on mixing two soluble salts in a solution. The absence of any visible change is due to the fact that the resulting products of reaction are soluble and there is nothing to separate out.

Example—

A prescription containing acids and bases may not give rise to any visible change, though they are chemically and physiologically incompatible with each other.

Re

Spt. ammon. aromat	...		℥i
Acid. hydrochlor. dil	...		℥i
Aquam	...	...	ad ℥vi

The chemical change may not be visible, but it does not follow from this that the resulting product is harmless.

Re

Potass. bicarb	...	...	gr. xx
Acid. hydrocyanic dil.		...	m. xviii
Aquam	...	...	ad ℥vi

Here potassium cyanide is produced which is as poisonous as hydrocyanic acid.

(2) *Heterogeneous.*—When there is a visible change of form, that is formation of a gas or precipitate.

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Chemical incompatibility includes cases where :—

(1) An acid is mixed with an alkali, resulting in neutralisation of action.

(2) A change of colour is produced as the result of chemical change.

(3) A precipitate is formed, as the result of—

(a) reaction between two soluble salts in a prescription ;

(b) separation of alkaloids from a solution ;

(c) decomposition of a weaker acid by a stronger acid.

(4) Gas is liberated.

(5) An explosive or combustible substance is produced.

1. Interaction of Acids and Alkalies.—

Acids and alkalies are incompatible with each other and should not be combined in a prescription.

When an alkali is added to an acid solution, a percipitate may be formed due to removal of the acid by the alkali. If for example, sodium bicarbonate is added to a solution of quinine in sulphuric acid, the acid will be neutralised and the quinine, which is an insoluble alkaloid will be precipitated from the mixture. Similarly a precipitate may be formed on the addition of an acid to an alkaline preparation.

Re

Ammon benzoas.	...	ʒi
Acid. sulphuric dil.	...	ʒi
Aquam ...	...	ad ʒvi

Insoluble benzoic acid will be precipitated.

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The combination of acids with alkalies is a common mistake. Such a mistake is due to the fact that there are some preparations the names of which do not suggest whether they are acids or alkalies.

Example—

Re

Spt. ammon. aromat.	...		ʒii
Potass. bicarb.	...	...	ʒi
Syr. scillæ	...	...	ʒiii
Aquam	...	...	ad ʒvi

Here syrup scillæ contains acetic acid, but the name of the preparation does not suggest that it is acid in reaction. It cannot be given with alkalies.

In these cases we have to deal with substances which although not usually regarded as acids or alkalies, nevertheless react as such ; and the reactions of such preparations should therefore be remembered.

Acid preparations	Alkaline preparations
(1) *Acids*—	(1) *Alkaline* (e. g. salts of sodium, potassium, calcium, magnesium, ammonia.)
(a) Mineral Acids, (e g. hydrochloric acid, nitric acid, sulphuric acid, hydrocyanic acid, phosphoric acid, etc.	
(b) Organic acids (e. g. acetic acid, etc.)	
(2) *Salts*—	(2) *Alkaline salts*—
(a) Acid salts—	(a) Borax.
Caffeine citrate (acid in water.)	(b) Sodium cacodylate (impure commercial forms).

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Acid preparations.	Alkaline preparations.
Cream of tartar. Double citrates, e. g. scale preparations of iron.— Ferri et ammon. citrate. Ferri et quinine citrate. Double sulphates, e. g. alum.	(c) Soap (sodium or potassium stearate).—Soaps are alkaline in reaction and this should be remembered in connection with soap emulsions and liniments.
(b) Basic salts—e. g. bismuth subnitrate.	
(3) *Official preparations containing free acid* (though their names do not suggest their reaction). Acetum scillæ. Confectio sulphuris (which contains cream of tartar). Inf. rosæ acidum. Lin. turpentine and acetic acid. Liq. arsenici hydrochlor. ,, ferri acetatis. ,, ,, perchloride. ,, pepticus. ,, strychnine hydrochlor. (now made neutral according to new B. P,) ,, ethyl nitritis (sometimes acid, though it should not be so according to pharmacopœial requirements). Spt. ætheris nitrosi (sometimes). Syr. calcium lactophosphatis. ,, ferri phosphatis. ,, ,, ,, cum quinina et strychnina (Easton's syrup). ,, lemonis. ,, scillæ. Vinegars and wines.	(3) *Official preparations which are alkaline* in reaction (the names of which do not suggest their reaction). (a) Lin. camphor ammoniata. (b) Lin. terebinthinæ. (c) Liq. bismuthi. (d) ,, arsenicalis (Fowler's solution). (e) ,, calcis (lime water). (f) Ammoniated tinctures. (g) Spt. ammon aromat.

The only exception to this rule is the intentional combination of sodium bicarbonate (alkaline) with hydrocyanic acid, the resulting alkaline cyanide having the same therapeutic action as hydrocyanic acid. In this case the

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incompatibility of an acid and an alkali is not of any significance as the salt formed has the desired effect.

II. Alteration in Colour.—

Certain substances when combined in a prescription give rise to change of colour due to chemical interaction and formation of an undesirable compound.

Examples—

Salts	When mixed with	Result of the combination
Iron salts ...	Astringents containing tannin e.g. all vegetable drugs (except quassia, calumba and chiretta).	Black colour due to formation of ink (or iron tannate).
Ferric chloride ...	Acetates ...	Blood red colour due to formation of ferric acetate (as in Basham's mixture, an useful prescription).
,, ...	Antipyrine ...	Deep red colour.
,, ...	Benzoates ...	Flesh coloured precipitate.
,, ...	Salicylates ...	Deep purple colour of ferric salicylate (often prescribed intentionally).
,, ...	Salol ...	Do
,, ...	Tinct. opii ...	Red colour of ferric meconate.
,, ...	Carbolic acid ...	Violet colour.
,, ...	Phenacetin ...	Deep red colour.

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Salts	When mixed with	Result of the combination
Infusion of rose (an acid preparation).	Excess of alkalies	The red colour of infusion of rose changes to green.
Spirit ætheris nitrosi.	Phenazone (antipyrine).	Brilliant green colour of nitroso-antipyrine.
,, ...	Resorcin ...	Dark red colour.
,, ...	Salicylates ...	Yellow or red colour.

III. Formation of a Precipitate.—

A. *Precipitation by the interaction of solutions of two soluble salts.—*

A chemical reaction always tends to form the most stable substance possible under the given condition; a precipitate therefore takes place whenever an insoluble stable body can be formed by the mutual interaction of any two soluble salts in a solution.

It is therefore essential first to know the salts that are soluble, as then it will be easy to remember the salts that are insoluble and hence liable to be precipitated.

Among the salts generally used in prescriptions, the following are liable to form insoluble compounds, viz. salts of calcium, magnesium, iron, lead, zinc, silver and mercury. In most cases a precipitate is formed due to separation of an insoluble compound (e.g. insoluble oxides, hydroxides, carbonates, phosphates, sulphates, iodides, chlorides, etc.) as a result of interaction of two soluble salts.

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Examples—

(*a*) *Formation of insoluble oxide.*—

(i) Yellow wash—

Mercuric chloride + Calcium hydroxide = yellow mercuric oxide.

$Hg\ Cl_2 + Ca\ (OH)_2 = HgO + Ca\ Cl_2 + H_2O.$

(ii) Black wash—

Mercurous chloride + Calcium hydroxide = ppt. of black mercurous oxide.

$Hg_2\ Cl_2 + Ca\ (OH)_2 = Hg_2\ O + Ca\ Cl_2 + H_2\ O.$

(iii) Liq. plumbi subacetatis + Lime water = ppt. of oxide of lead.

(iv) Zinc sulphate + Calcium hydroxide = ppt. of zinc oxide.

(*b*) *Formation of insoluble chlorides.*—

Silver nitrate + tap water = ppt. of insoluble silver chloride, as tap water contains chlorides.

(*c*) *Formation of insoluble iodides.*—

Potassium iodide + Hydrarg. perchloride = ppt. of red mercuric iodide which is however soluble in excess of the potassium iodide (often intentionally prescribed).

(*d*) *Formation of insoluble carbonates.*—

Ferrous sulphate + Potassium carbonate = green ppt. of insoluble ferrous carbonate (compare—Mist. ferri co, of B. P. and Blaud's pill).

$FeSO_4 + K_2\ CO_3 = FeCO_3 + K_2\ SO_4.$

Calcium lactate + Spt. ammon. aromat. = insoluble precipitate of calcium carbonate.

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(*e*) *Formation of insoluble phosphates.*—

Acid phosphoric dil. + Tinct. ferri perchlor. = precipitate of ferrous phosphate.

(*f*) *Formation of insoluble sulphates.*—

(i) Lead acetate + Mist. sennæ co.—

Mist. sennæ, co. contains spt. ammon. aromat. and magnesium sulphate and therefore precipitate of lead carbonate and lead sulphate will be thrown down.

(ii) Calcium chloride + Sodii sulphate = ppt. of insoluble calcium sulphate (plaster of Paris).

(*g*) *Formation of insoluble tannates.*—

Tannates are usually insoluble in water and therefore most of the heavy metals (lead, silver, per-salts of iron etc.) are precipitated by tannic acid or substances containing tannin.

Example—

℞

Quin. sulphas	...	gr. xii
Acid hydrochlor. dil	...	m. xxiv
Inf. rhei ...	...	ad ʒ vi

As infusion rhei contains tannin a precipitate of tannate of quinine will be thrown down.

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Name of the substance	Its soluble salts	Its insoluble salts	It is incompatible with substances which form its insoluble salts, such as
Calcium ...	Chlorides ; bromides ; lactates.	Hydroxides (slaked lime) ; carbonates (chalk) ; sulphates (plaster of Paris) ; phosphates.	Soluble alkaline hydroxides, carbonates, sulphates and phosphates.
Magnesium	Sulphates. ...	Do. (except sulphates).	Same as above, except bicarbonates and ammon. carb.
Iron ...	Sulphates ; chlorides ; citrates ; nitrates ; tartrates ; arsenates.	Hydroxides ; carbonates ; phosphates.	Soluble alkaline hydroxides, carbonates and phosphates.
Zinc ...	Sulphates ; chlorides.	Oxides ; hydroxides ; carbonates (calamine) ; phosphates ; borax (sodium biborate).	Soluble alkaline hydroxides, carbonates, phosphates and borax.
Copper ...	Sulphates. ...	Do.	Do.
Lead ...	Acetates ; subacetates.	Oxides ; bromides ; chlorides ; iodides ; sulphides ; carbonates ; citrates ; phosphates ; salicylates ; tannates etc.	Soluble oxides and hydroxides, bromides, chlorides, iodides, sulphides, carbonates, citrates, phosphates, salicylates, tannates, tartrates etc.
Silver ...	Nitrate. ...	Chlorides.	Soluble chlorides.
Mercury ...	Nitrate ; perchloride.	Oxides ; iodides.	Soluble oxides and iodides.

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Calcium.—

Calcium chloride, bromide and lactate are the soluble salts of calcium. When they are mixed with soluble oxides, hydroxides, carbonates, sulphates and phosphates of all alkalies, the result is a precipitate due to the formation of insoluble compounds. It should be remembered that calcium hydroxide (slaked lime), carbonate (chalk), sulphate and phosphate are insoluble in water.

Example—

Re

Calcii chlorid.	...	...	ʒi
Sodii sulphas	...	...	ʒvi
Aquam	...	...	℥vi

A precipitate of calcium sulphate (plaster of Paris) is thrown out.

Magnesium.—

Magnesium sulphate, the soluble salt of magnesium, is incompatible with all oxides, hydroxides, carbonates and phosphates (as magnesium oxides, hydroxides, carbonates and phosphates are insoluble in water). The only exception to this rule is that they are compatible with ammonium carbonate and with the bicarbonates.

Re

Mag. sulphas	...	...	ʒvi
Sodii phosphas	...	...	ʒvi
Aq. menth. pip.	...	...	ad ℥vi

In this case a flocculent precipitate of magnesium phosphate is produced.

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Iron.—

The soluble salts of iron, namely iron sulphate, perchlorides, citrates, nitrates, tartrates and arsenates give a precipitate with the soluble *i, e.*, the alkaline hydroxides, carbonates and phosphates (as hydroxides, carbonates and phosphates of iron formed as result of these unions are insoluble salts).

The most common example of such incompatibility, which is however intentional, is the Blaud's pill. Here ferrous sulphate is combined with potass, carbonate producing a precipitate of green ferrous carbonate.

Zinc.—

Zinc chlorides and sulphates, the soluble salts of zinc, are incompatible with alkaline hydroxides, carbonates, phosphates and also with borax (sodium biborate).

Copper.—

Copper sulphate, the soluble salt of copper, is incomparible with alkaline oxides, hydroxides, carbonates, phosphates and also with borax (just like zinc).

Lead.—

Most of the lead salts are insoluble ; consequently the only soluble salts of lead, *i. e.*, acetates and subacetates very readily precipitate with most substances (*e. g.*, oxides, bromides, chlorides, iodides, benzoates, carbonates, sulphates, chromates, citrates, phosphates, salicylates, tannates, tartrates etc.)

Silver.—

Silver nitrate, which is a soluble salt, is incompatible with all chlorides (as the resulting silver chloride is insoluble)

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and also with most solutions as the majority of silver salts are likewise insoluble. As tap water contains chlorides, solutions of silver nitrate should be made only with distilled water free from chlorides.

Examples—

(i) Re

Silver nitrate	...	...	℥i
Cocainæ hydrochlor		...	℥i
Aq. dest.	...	...	ad ℥vi

A precipitate of silver chloride is formed.

(ii) Re

Silver nitrate	...	...	℥ss
Sodii chlorid.	...	...	grs. xv
Aquam	...	...	ad ℥vi

Insoluble chlorides will be formed and precipitated. Sodium chloride is therefore used to neutralise any excess of silver nitrate when locally applied to the skin or eye or used as an antidote in poisoning. The reaction is as follows—

$$Ag\ NO_3 + Na\ Cl = Ag\ Cl + Na\ NO_3$$

$$6AgNO_3 + Cl_6 + 3H_2\ O = 5\ AgCl + Ag\ ClO_3 + 6HNO_3.$$

Mercury.—

The insoluble salts of mercury are the oxides, iodides, subchlorides (calomel) and hydrarg. ammoniata ; and consequently the soluble salts of mercury (i. e. mercuric chloride and mercuric nitrate) are insoluble with all soluble oxides, iodides etc. (as oxides of mercury, mercuric iodides, etc. are insoluble in water.)

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Examples—

(i) Potass. iodide + Hydrarg. perchloride = ppt. of red mercuric iodide, which is however soluble in excess of potassium iodide forming a colourless double salt.

(ii) Black wash.—

Calomel + Calcium hydroxide = ppt. of mercuric oxide.

(iii) Yellow wash.—

Hydrarg. perchloride + Calcium hydroxide = ppt. of mercuric oxide.

B. *Precipitation due to separation of an insoluble alkaloid.*—

All alkaloids in the free condition are insoluble, though most of the salts of alkaloids are soluble in water. So alkaloids are given with acids to form soluble salts. If however an alkali is mixed with such a solution, it will neutralise the acid and precipitate the alkaloid again, which can no longer be held in solution.

Example—

Re

Quin. sulphas ...	...	grs. vi
Acid. sulph. dil	...	m. xii
Spt. ammon. aromat	...	ʒii
Aquam ...	...	ad ʒvi

The alkaline ammonia will neutralise the acid and quinine will be precipitated.

C. *Liberation of an insoluble acid due to decomposition of a weaker acid by a stronger acid.*—

A stronger acid decomposes salts of a weak acid. This is due to the fact that the stronger acid has a greater

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affinity for the base. It therefore combines with the base and sets free the weaker acid. Instances of such incompatibility are the combination of a mineral acid (e. g., hydrochloric acid, nitric acid, sulphuric acid etc.) with a salicylate, benzoate or cinnamate.

Examples—

(a) Salicylates.—

(i) Sodii salicylate + Hydrochloric acid = ppt. of salicylic acid.

(ii) Caffeine citrate solution + Sodii salicylate. Caffeine citrate is readily decomposed in aqueous solution, citric acid being set free. This citric acid acts on the salicylate, giving a precipitate of salicylic acid.

(b) Benzoates.—

(i) Sodii benzoate + Nitric acid = ppt. of benzoic acid.

(ii) Ammon. benzoate + Inf. rosæ acidum (which contains sulphuric acid) = abundant crystalline precipitate of benzoic acid.

Exceptions.—Acetic acid and benzoic acid will not cause any precipitation.

IV. Formation of Gas.—

Sometimes gas is formed as result of chemical action among the ingredients of a prescription.

(1) *Evolution of CO_2 gas.*—

When an acid stronger than carbonic acid is combined with a solution of a carbonate or bicarbonate, the stronger

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acid forms a salt with the base with the evolution of CO_2 gas.

Examples—

Re

Bismuth subnitras.	...		ʒii
Sodii bicarb. ...	...		ʒii
Mist. cretæ ...	...	ad	ʒvi

Bismuth subnitrate, being acid, gives rise to slow effervescence when mixed with bicarbonate of soda or chalk mixture (which contains calcium carbonate). These are sometimes combined in a prescription, but it is better to avoid such a combination.

Confectio sulphuris, which contains acid potassium tartrate, should not be given with Grey powder (hydrarg. cum creta) which contains chalk. CO_2 gas will be given off by the action of the acid tartrate of potash on the chalk and a pasty mass will result.

Liquid preparations of pepsin contain hydrochloric acid and should not be prescribed with sodium bicarbonate.

Never add syrup lemon, syrup squill or oxymel squill, which are all acid preparations to a cough mixture containing sodii bicarbonate, potass. bicarbonate, ammon. carbonate or spt. ammon. aromat.

Sometimes however advantage is taken of the production of CO_2 gas by the interaction between acid and alkali in the prescription of effervescent mixtures. The following prescription is an example of intentional combination of an acid with an alkali,

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Examples—

Re

Sodii bicarb.	...	...	grs. xv
Aquam	...	...	ad ℥i

M. Sig. No. 1

Acid citric	...	...	grs. xv

Ft. Pulv. Sig. No. 2

Add No. 2 to No. 1 and take during effervescence.

(2) *Evolution of free oxygen.*—

Sometimes when two oxidising agents are mixed together, they reduce each other with evolution of free oxygen.

Examples :—

(i) Hydrogen peroxide + Potass. permanganate solution. —These two when mixed together reduce each other forming water and manganese dioxide with liberation of oxygen ; and should not be given in a prescription.

(ii) Hydrogen peroxide + Chloramine T. Here hydrogen peroxide is reduced with evolution of oxygen.

(3) *Evolution of Chlorine gas.*—

Re

(i)

Potass chloras.	...	...	℥i
Alum	...	...	℥i
Aquam	...	...	ad ℥vi

Chlorine gas is liberated.

(ii) Re

Potass chloras,	...	... ℥i
Acid. hydrochlor. dil.		... ℥i
Aq. dest,	...	ad ℥vi

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Here a gargle containing free chlorine is wanted. The powdered potassium chlorate is put into a stoppered bottle and the acid is added to it. The bottle is then corked and warmed in hot water. When the reaction is complete some water is added to the mixture, which is agitated to dissolve the gas formed and then made up with the total amount of distilled water.

(4) *Liberation of Iodine.*—

Iodine vapour may be liberated from a mixture by the action of—

(i) acids and acid salts.—

For example, when potassium iodide is mixed with dilute nitric or nitromuriatic acid the solution becomes brown from the liberation of iodine.

Spt. ætheris nitrosi (if acid) decomposes potassium iodide with the liberation of free iodine.

Acid acetyl salicylic (aspirin) also decomposes iodides.

Re

Bismuth subnitras.		...	ʒi
Potass. iodid.		...	ʒi
Aquam	...	...	ad ʒvi

The mixture will soon turn yellow from formation of bismuth iodide and liberation of iodine.

(ii) A strong oxidising agent.—

When potassium chlorate is mixed with syrup ferri iodide, iodine is liberated. In this case there is gradual reduction of the chlorate to chloride and liberation of iodine from ferrous iodide. [$KClO_3 + 2\ Fe\ I_2 = Fe_2\ O_3 + KCl + 2\ I_2$]

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Explosive and Inflammable Combinations —

An explosion is a sudden decomposition with rapid evolution of gas and attended with noise and sometimes with flame. Substances which when combined under ordinary circumstances give rise to simple effervescence may under suitable conditions cause a sudden and violent production of gas and explosion.

A. *Unstable single compounds.*—

These compounds contain a store of energy, in a condition of stress, which is liable to be liberated with evolution of heat when they are rubbed or heated.

(1) Hypophoshites—are dangerous substances as they may explode even when singly rubbed in a mortar or heated. A druggist lost his life from explosion due to heating calcium hypophoshite over a sand bath.

(*2*) *Erythrol tetranitrate.*—It is very sensitive to percussion and liable to explode.

(3) Mannitol hexanitrate—explodes violently when struck with a hammer or heated.

(*4*) *Nitroglycerine and trinitrine.*—Strong alcoholic solutions of nitroglycerine are dangerous as they may explode even when shaken or agitated. A one percent. alcoholic solution is however safe ; but when this liquor trinitrini is diluted with water and allowed to stand an oily substance is deposited which is explosive. One drop of this oily substance when absorbed by paper and struck with a hammer on a hard surface gives rise to explosion. The danger of explosion depends mainly on evaporation, permitting the separation of oily drops of nitroglycerine.

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$$2C_3H_5(NO_3)_3 = 6CO_2 + 3N_2 + 5H_2O + O$$

If liquor trinitrini is spilled, a little caustic potash (which being an alkali is incompatible with it) should be quickly poured over it to cause decomposition.

(5) *Picric acid and picrates.*—These explode when rubbed violently or heated dry.

B. Explosion due to rapid chemical action (oxidation or reduction) between oxidising and reducing agents.—

There are some substances which contain a large percentage of disposable oxygen and part with it readily and are called *oxidising agents.*

Reducing or oxidisable agents are those substances which readily combine with oxygen.

Explosion may occur when the oxidising agents are mixed with oxidisable substances. A list of the common oxidising and reducing agents is given in the next page. It will indicate various pairs of dangerous incompatibles which might be encountered in practice.

(1) *Examples of combination in the dry state.*—

(a) *Potassium chlorate* is a dangerous drug and is liable to explosion when mixed with any reducing substance in a dry condition.

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Oxidising agents	Oxidisable or reducing agents
Bromine and Bromates	Arsenious acid
Chlorine and Chlorates, hypochlorites (bleaching powder) and nitro-hydrochloric acid.	Cyanides
	Formalin
Chromates, bichromates and chromic acid.	Iron reduced ; ferrous salts
	Mercurous salts
Cupric salts	
	Metals in free state or in colloidal or finely divided state.
Ferric salts (particularly the chlorides)	
Iodine and iodates	Organic substances—
Lead dioxide	(a) Vegetable products.—e.g. alcohol, camphor, carbohydrates, catechu, charcoal, cork, creosote, ether, extracts, gallic acid, honey (contains sugar), lycopodium, morphine, volatile and fixed oils, opium, pyroxylin, saccharin, sugars, syrups, tannins, turpentine, vegetable drugs etc.
Manganese dioxide	
	(b) Animal products.—bone charcoal, fats, glycerine.
	Nitrites.
Mercuric salts	Oxalates
Nitrates	Phosphorus—which ignites spontaneously in air and is always kept under water. Hypophosphites
Permanganates	
Peroxides e.g. Hydrogen peroxide	Pyrogallol
Per-sulphates	Sulphur, sulphides, sulphites and hyposulphites ; compound liquorice powder (which contains sulphur)
Picrates	
Silver oxides	Stannous salts
Sulphuric acid	Zinc powder

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It explodes when triturated with :—

(i) Calcium hypophosphite.—

Re

Potass. chloras.	...	ʒiv
Calcii hypophosphite	...	ʒiv

This powder was rubbed by a student, when suddenly it took fire, causing severe burns.

(ii) Organic substances e. g., mixing potassium chlorate with charcoal to prepare tooth powder.

Re

Potass. chloras.	...	ʒi
Sugar	...	ʒi

As sugar is an organic substance, explosion takes place when it is rubbed with the chlorate ; but if they are mixed after rubbing them separately there will be no explosion.

(iii) Sulphur.—It forms an explosive combination with potassium chlorate. It should be remembered that pulv. glycerrhizæ co. contains sulphur and should not be rubbed with potass. chlorate.

(iv) The astringent drugs containing tannin—

Re

Potass. chloras.	...	ʒi
Tannic acid	...	ʒi

A violent explosion occurred when these were rubbed in a new mortar with a rough surface.

(*b*) *Sulphur* + Calcium chloride = explosion when rubbed together in a mortar.

(*c*) *Bismuth Subnitrate* + sodii. bicarbonate.—

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CO_2 gas is evolved producing effervescence. If the bottle is lightly corked and kept in a cool place no explosion will take place. But if it is tightly corked and kept in a *warm* place, there may be violent reaction with sudden evolution of gas resulting in an explosion.

(2) *Examples of combination in the moist or liquid state.*—

(*a*) *Chloral hydrate* + Spt. ammon. aromat. = evolution of gas, which may produce an explosion.

(*b*) *Chromic acid* (CrO_3), which is an oxidising substance explodes when mixed with organic substances.

Re

Acid chromic	...	ʒi
Glycerine	...	ad ʒi
Mix		

A chemist dissolved the chromic acid in a little water, added the glycerine and shook up the mixture, when an explosion took place and the contents of the bottle were scattered.

Bichromates also form explosive compounds in the presence of mineral acids.

(*c*) *Hydrogen peroxide* (H_2O_2) contains nascent oxygen and is better prescribed alone. There is a case on record where a bandage soaked in a solution of H_2O_2 ignited when dry.

(d) *Iodine.*—

Tinct. of iodine and ammonia solution = a black precipitate of nitrogen iodide, which is a dangerous explosive.

Iodine ignites oil of turpentine and also explodes when combined with other essential oils.

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(*e*) *Nitric acid.*—It acts violently upon carbolic acid, creosote, glycerine and on some volatile oils.

Saw-dust has been set on fire by spilling nitric acid upon it.

(*f*) *Potassium chlorate.*—

(i) Re

Potass. chloras.	...	...	ʒii
Tinct. ferri perchlor.		...	ʒii
Glycerine	...	...	ad ʒi

This preparation is liable to explode when warm. A patient was carrying a bottle containing this mixture in his pocket, when an explosion took place.

(ii) Re

Potass. chloras.	...	...	gr, i
Amyl nitrite	...	...	m. i

Ft. capsule.

Potass. chlorate is blazed up when mixed with amyl nitrite. Smith described an accident which took place in a chemical factory in London. A man broke a capsule of amyl nitrite and accidentally threw out the wrapping cotton soaked with the drug into a barrel, containing pot. chlorate. Fire broke out and the building was saved with difficulty.

(iii) Re

Potass. chloras.	...	...	ʒii
Tinct. iodi.	...	...	ad ʒi

Iodate of nitrogen is formed and explosion takes place.

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(*g*) *Potassium permanganate.*—It is better prescribed alone with simple water. When potassium permanganate pill is ordered for cholera it should be prescribed alone and kaolin used as its excipient.

Re

Potass. permang.			
Alcohol	...	...	aa. 10 parts
Aquam	...	...	15 ,,

This mixture exploded, the boiling liquid being scattered on the face causing injury,

(*h*) *Silver.*—

(i) Silver oxide may explode, when rubbed with confection of rose, ext. gentian, carbolic acid, creosote or potassium permanganate. It may however be made into pill without much danger by diluting it previously with kaolin and then massing with hydrocarbons. Pills containing silver oxide if massed with soap or other reducing agents swell up and rarely explode.

Silver oxide also explodes with liquor ammonia.

(ii) Silver nitrate—

Silver nitrate + creosote = takes fire when warm.

(*i*) *Spirit ætheris nitrosi.*—It may explode when mixed with tannic acid or astringent vegetable infusions containing tannin, such as catechu, buchu, etc, due to formation of gaseous compounds of nitrogen.

Re

Spt. ætheris nitrosi	...	℥ii
Mist. amygdalæ	...	ad ℥vi

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This mixture may explode, as gum which is one of the ingredients of the almond mixture contains tannin.

Prevention of Chemical Incompatibility.—

Chemical reaction between two or more substances can sometimes be retarded or even prevented by :—

(1) Suitable dilution of one of the drugs in the prescription before adding the other.

(2) Paying attention to the order of mixing the ingredients in a prescription.

Re

Hydrarg. perchlor.	...	grs. iii
Ammon. carb.	...	ʒss
Potass. iodid.	...	ʒss
Aquam ...	...	ad ʒvi

If hydrarg. perchloride is mixed direct with ammonium carbonate following the order in the prescription, a precipitate of hydrarg, ammoniata is formed. But if hydrarg. perchloride and potassium iodide are first dissolved and then ammonium carbonate is added to this solution, no precipitate will be formed.

Re

Tinct. ferri perchlor.	...	ʒiss
Spt. ammon. aromat.	...	ʒii
Aquam ...	...	ad ʒvi

When the ingredients in this prescription are mixed in the order as written, the iron will be precipitated. But if the order is changed and the tincture ferri perchloride is first diluted with water and then spirit ammon, aromat, is added most of the iron will remain in solution.

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PHYSIOLOGICAL INCOMPATIBILITY

Synonyms : Therapeutical incompatibility ; antagonism.

Definition : When drugs having opposite pharmacological action are given in a prescription, they counteract each other's action. This is known as physiological incompatibility or antagonism.

A drug is used for its therapeutic action on the human body. The object is frustrated if the specific action of the drug is modified or neutralised as a result of wrong combination in a prescription. A knowledge of drugs which are antagonistic in their pharmacological action is therefore absolutely necessary to prevent any such error.

Example of drugs with antagonistic therapeutic action :—

Name of drug	Antagonist
Atropine—dilates pupil and stimulates respiration.	Morphine—contracts pupil and depresses respiration.
,, decreases sweat.	Pilocarpine—causes sweating.
,, dilates pupil.	Eserine—contracts pupil.
Digitalis—stimulates heart.	Aconite—weakens heart.
Purgatives—cause purging.	Astringents—cure diarrhœa
Strychnine—a stimulant.	Bromides, Chloral hydrate, Physostigmine } depressants

Mode of action :—In case of physiological incompatibility there is no chemical affinity between the drugs and

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no chemical reaction takes place, but the antagonistic effects are produced by their action either—

(1) On the *same* structure—

Example :

{Bromides—depress the spinal cord.
{Strychnine—stimulates the spinal cord.

or (2) On different structures—

Examples :

Adrenaline—*contracts* blood vessels by stimulating the *nerve endings.*

Amyl nitrite—*dilates* the blood vessels by its direct action on the *muscles.*

It is thought that this antagonism or counteraction of the effects of the different ingredients in a prescription takes place either in the blood or in the tissues.

Classification :—

(1) *Real antagonism.*—Where the drugs produce opposite effects by acting on the same structure.

Examples :

(i) Bromides—depress the spinal cord.
Strychnine—stimulates the spinal cord.

(ii) Atropine—decreases salivation and perspiration ;

Pilocarpine—increases salivation and perspiration and contracts the pupils. Pilocarpine is directly antagonistic to atropine in its effects upon the secretory nerves, the nerve endings governing the

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involuntary muscles, the ends of the vagus nerve and the terminations of the third or oculomotor nerves in the eye.

(2) *Apparent antagonism.*—Here also the drugs produce opposite effects, but they do so by acting on *different* structures.

Examples :

(i) Adrenaline—constricts blood vessels by acting on the nerve endings.

Amyl nitrite—dilates blood vessels by acting directly on the muscles.

(ii) Morphine and atropine are to a certain extent examples of apparent incompatibility. Morphine contracts the pupils by acting on the pupillary centre in the aqueduct of Sylvius, while atropine dilates the pupils by paralysing the ciliary branches of third nerves in the eye. Morphine again acts as a diaphoretic by its action on the central nervous system, while the anhydrotic effect of atropine is due to its action on the nerve endings in the gland.

There is no drug which can fully and completely counteract each other's action on all points. Most of the cases are examples of partial antagonism.

INTENTIONAL INCOMPATIBILITY

An apparent physical or chemical incompatibility does not necessarily affect the useful therapeutic action of the mixture. Sometimes incompatible drugs are combined purposely and these cases are examples of intentional incompatibility.

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(1) Incompatible drugs may be mixed purposely with the object of utilising the therapeutic properties of the product of reaction.

Examples :—

(*a*) All effervescing perparations.—

(i) Re

Sodii bicarbonas.	...	...	grs. xv
Aquam	...	...	ʒi
M. Sig. no. 1	...	...	
Acid citric	...	...	grs. xv

Ft. pulv. Sig. no. 2

Add no. 2 to no. 1 and take during effervescence.

In this case, advantage is taken of the production of CO_2 gas by the chemical action between the acid and the alkali in the prescription.

(ii) This is the same with Seidlitz powder.—

Re

Soda et potassæ tartarata	...	grs.	120
Sodii bicarbonas.	...	,,	40

M. Wrap in blue paper. Sig. no. 1.

Re

Tartaric acid	...	...	38 grs.

Wrap in white paper. Sig. no. 2.

Dissolve no. 1 in ½ pint of water and then add no. 2, and drink while effervescence.

(iii) Sodii citro-tartras effervescens—contains sodium bicarbonate, citric acid and tartaric acid and so effervesces on the addition of water.

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(*b*) Chlorine mixture.—

Re

Potass. chloras.	...	grs. xxx
Acid. hydrochloric dil.	...	ʒi
Syrup aurantii	...	ʒvi
Aquam	...	ad ℥vi

(*c*) Lotio hydrarg. flava (yellow wash).—

Re

Mercuric chloride	...	grs. 40
Lime water	...	pint 1

The insoluble mercuric oxide which is formed is used as a local application,

(*d*) Lotio hydrargyri nigra (black wash).—

Re

Calomel	...	grs. xxx
Glycerine	...	ʒiv
Muc. tragacanth	...	℥i
Lime water	...	ad ℥x

The insoluble black or mercuric oxide, which is formed, is suspended in the mucilage and is used as a local application.

(2) The compound formed by the interaction between two or more substances in a prescription may have the same therapeutic action and may be therapeutically equivalent to the original substances. In such cases the incompatibility is more apparent than real and there is therefore no objection to use such a prescription.

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Re

Sodii bicarbonas.	...	℥ss
Acid. hydrocyanic dil.	...	m. xviii
Aquam	...	ad ℥vi

Here the alkaline sodium bicarbonate is incompatible with the acid ; but still this prescription is used by all physicians as the alkaline cyanide which is formed has the same therapeutic action as hydrocyanic acid.

(3) The incompatibility may be of no importance e. g. combination of vegetable astringents containing tannin with iron salts (= tannates), tincture ferri perchloride or tincture of opium (= ferric meconate).

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INCOMPATIBILITIES OF COMMON SUBSTANCES

ACIDS

[For list of acids and acid preparations, see pages 13-14.]

Acids are incompatible with :—

(1) *Alkalies.*—

Re

Liq. ammon. acet.	...	ʒiii
Acid. sulphuric dil.	...	ʒi
Aquam	...	ad ʒvi

Acetic acid will be formed, giving out salts of acetic acid.

Alkaline carbonates when mixed with acids will cause effervescence.

Ammon. carb.	...	ʒss
Syr. scilla	...	ʒii
Inf. senegæ	...	ad ʒvi

Syrup of squill contains acetic acid and is therefore acid in reaction. So if it is mixed with the alkaline ammonium carbonate, CO_2 gas will be formed, which may cause explosion in the bottle.

Re

Mag. carb.	...	ʒi
Inf. rosæ acidum	...	ad ʒvi

Infusion of rose is acid in reaction and so when it is mixed with the alkaline carbonate, there will be effervescence and change in colour, the mixture becoming first blue and then brown.

Hydrarg. cum creta (grey powder), chalk mixture etc, should not be given with acids.

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Sodium bicarbonate is however intentionally combined with dilute hydrocyanic acid. The therapeutic action of the alkaline cyanide, formed as result of this combination, is almost similar to that of hydrocyanic acid ; and so this is a useful prescription.

(2) *Alkaline salicylates, benzoates and cinnamates.*— These are decomposed by mineral acids and organic acids are liberated.

Sodii salicylas.	...		℥i
Acid. hydrochlor. dil.	...		℥i
Aquam ...	...	ad	℥vi

Salicylic acid is precipitated.

Re

Ammon, benzoas.	...		℥ss
Acid. hydrochlor. dil.	...		℥ss
Aquam ...	...	ad	℥vi

Insoluble benzoic acid will be thrown down.

(3) *Iodides.*—

Iodides cannot be prescribed with mineral acids, as it will result in the liberation of iodine.

Re

Potass. iodid.	...		℥ss
Acid. nitric dil.	...		℥i
Aquam ...	...	ad	℥vi

Nitric acid decomposes potassium iodide and iodine is liberated. In this case the reaction occurs in three stages :—

(i) $2\,HNO_3 + 2\,KI = 2\,HI + 2\,KNO_3$

(ii) $HNO_3 + 2\,HI = HNO_2 + H_2O + I_2$

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(iii) $HNO_2 + HNO_3 + KI = KNO_3 + H_2O + NO + I$

The free iodine may be detected by starch or by the rose red colour imparted to chloroform when agitated with the mixture.

(4) Bromides—are incompatible with strong mineral acids.

(5) *Extract glycyrrhizæ liquidum*—should be prescribed only in neutral or alkaline mixture as glycyrrhizin is precipitated by acids.

Re

Quin. sulphas.	...	ʒss
Acid hydrochlor. dil.	...	ʒii
Ext. glycyrrhizæ liq.	...	ʒii
Aquam	...	ad ʒvi

A precipitate is formed.

(6) Mucilage of Acacia.

ACID HYDROCYANIC DIL.

Acid hydrocyanic dil. is incompatible with :—

(1) *Most metallic salts*—e.g. soluble salts of iron, copper, lead, mercury, silver etc, producing insoluble cyanides.

Re

Liq. hydrarg. perchlor.	...	ʒi
Acid. hydrocyanic dil.	...	m. xx
Aquam	...	ad ʒvi

Cyanide of mercury, a poison, is formed.

Acid hydrocyanic dil. is however often intentionally prescribed with iron salt for its selective action to correct the irritant action of iron on the stomach.

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Re

Ferri et ammon. cit.	...	℥ss
Acid. hydrocyanic dil.	...	℥ss
Aquam ...	...	ad ℨvi

In this prescription the amount of hydrocyanic acid is very small and so no reaction is likely to occur. But if the prescription is made alkaline, ferrocyanide may be formed.

(2) *Morphine* (*in strong solution only*).—

If hydrocyanic acid is added to a concentrated solution of morphine, cyanide of morphine is said to be precipitated. In a prescription however morphine is used in such a small quantity that no precipitate is formed and the combination is often intentional.

Re

Liq. morphinæ hydrochlor.	...	℥i
Acid. hydrocyanic. dil.	...	m. xx
Aq. chlorof.	...	ad ℨvi

No precipitate will be formed.

N.B. Unlike other acids, hydrocyanic acid is *prescribed with alkaline carbonates and bicarbonates* and is not therapeutically incompatible with them.

Example—

Re

Sodii bicarb.	...	℥ii
Acid. hydrocyanic dil.	...	m. xx
Aquam ...	...	ad ℨvi

Alkaline cyanide which is produced has almost the same therapeutic effect as the acid.

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ALKALIES.

[For list of alkaline preparations see p. 13-14]

Alkalies are incompatible with :—

(1) *Acids and acid preparations.*

(*a*) Free acids.—

Preparations of squill e. g. vinegar of squill, oxymel of squill or syrup of squill, contains acetic acid and so will react with alkaline carbonates.

Re

Ammon. carb	...	ʒi
Syr. scillæ	...	ʒii
Inf. senegæ	...	ad ʒvi

Syrup of squill contains acetic acid and the prescription is therefore incompatible.

(*b*) Salts with acid reaction.→

Re

Hydrarg. cum creta	...	gr. 1/6
Confectio sulphuris	...	ʒi

Confectio sulphuris contains cream of tartar, which is an acid salt and when these two are rubbed together the pasty mass slowly swells and becomes frothy due to evolution of CO_2 gas.

Re

Sodii bicarb.	...	ʒi
Bismuth subnitras.	...	ʒi
Aquam ...	...	ad ʒvi

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Bismuth subnitrate, which is acid in reaction, slowly decomposes the alkaline bicarbonate and after the bottle has been put aside for sometime it may burst. The reaction is as follows :—

$$2\ BiONO_3 + NaHCO_3 = Bi_2O_2CO_3 + 2\ NaNO_3 + H_2O + CO_2$$

Bismuth carbonate however does not cause such effervescence.

Re

Potass, bicarb.	...	...	℥iss
Glyc. aluminis	...	...	℥vi
Aquam	...	...	ad ℥vi

Double sulphates are acid in reaction. Alum being a double sulphate is acid and is consequently incompatible with alkalies. When the above mixture is prepared, effervescence takes place at once, due to liberation of CO_2 gas, and there is precipitate of aluminium hydroxide.

$$[Al_2(SO_4)_3 + K_2SO_4] + 6\ KHCO_3 = Al_2(OH) + 4\ K_2SO_4 + 6CO_2$$

Re

Borax	...	...	℥i
Alum	...	...	℥i

Borax (sodium biborate) which is an alkaline substance, forms a moist mass when triturated with alum (an acid double sulphate) through the liberation of water of crystallisation of the latter. It may be mentioned here that though borax is alkaline, glycerine boracis is acid and so cannot be given with alkaline preparations.

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(2) *Alkaloids.*—On mixing an alkaline preparation with an alkaloidal salt, the basic alkaloid will be precipitated.

Re

Quin. sulphas	...	℥ss
Acid. sulphuric dil.	...	℥i
Sodii acetas	...	℥i
Aquam. ...	...	ad ℨvi

Quinine being an alkaloid is incompatible with the alkaline sodium acetate and quinine acetate is precipitated.

Atropine and hyoscyamine, though alkaloids, are not precipitated by the bicarbonates nor by ammonium carbonate.

(3) *The ordinary soluble salts of iron*—are incompatible with alkalies.

Re

Tinct. ferri perchlor.	...	℥i
Liq. ammon. acet.	...	℥vi
Aquam	...	ℨvi

Hydrate of iron will be precipitated.

N. B. If dilute acetic acid is now added to the above mixture, a red solution of ferric acetate will be formed. The following prescription, known as the Basham's mixture, is used in chronic parenchymatous nephritis.

Re

Tinct. ferri perchlor.	...	℥i
Liq. ammon. acet.	...	℥vi
Acid. acetic dil.	...	℥ss
Aquam ...	...	ad ℨvi

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(4) *Mercuric chloride.*—Corrosive sublimate should never be prescribed with any substance having an alkaline reaction.

Re

Liq. hydrarg. perchlor.	...	ʒss
Liq. arsenicalis	...	ʒss
Aquam ...	...	ad ʒvi

Liq. arsenicalis is an alkaline preparation and this prescription is therefore incompatible.

Sometimes mercuric chloride is intentionally combined with alkalies for external application e.g., in lotio hydrargyri flava, lotio hydrargyri nigra and hydrarg, ammoniata.

(5) *Chloral hydrate.*—

Re

Chloral hydras. ...	...	ʒi
Borax ...	...	ʒi
Aquam ...	...	ad ʒvi

The alkaline borax solution decomposes chloral hydrate with the formation of sodium formate and chloroform.

Re

Chloral hydras. ...	...	ʒi
Ammon. carb. ...	...	ʒss
Aquam ...	...	ad ʒvi

Chloral hydrate is decomposed by the alkaline carbonate and chloroform gas is produced.

(6) *Oils*—which form soap with alkalies ; but this is often intentional, as for example to prepare an emulsion.

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Special Cases

Carbonates.—Carbonates, e. g., ammonii carbonas, are as usual incompatible with all substances which cannot be given with alkaline preparations. They are also incompatible with all non-alkaline metallic salts.

Ammonium carbonate.—Being alkaline, its incompatibles are same as those of other alkaline preparations. It should be remembered however that it is decomposed by sodium and potassium carbonates with the liberation of free ammonia. It is also incompatible with metallic salts with the exception of mercury, copper and silver.

Re

Liq. ammon. acet.	...	...	℥v
Potass. carb.	...	...	℥i
Aquam	...	...	ad ℥vi

Ammonia gas is evolved and may be detected by the peculiar smell.

Sodium bicarbonate.—It is also incompatible with acid solutions, alkaloids, soluble salts of iron, mercuric chloride and chloral hydrate.

It is incompatible with mercuric chloride, but may be given with mercurous chloride (calomel).

Re

Hydrarg. subchloride	...	...	gr. ii
Sodii bicarb.	...	...	gr. iii

Mft. pulv. one.

A mixture containing sodium bicarbonate and sodium salicylate slowly darkens in colour. This is due to the presence of minute quantities of sesqui-carbonate in the sodium bicarbonate.

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When strontium bromide is given with sodium bicarbonate there is a precipitate of strontium carbonate.

Borax (*sodium biborate*).—Solution of borax is strongly alkaline and so it is incompatible with acids, alkaloids etc, like other alkalies. A peculiarity of borax is that it becomes acid when mixed with glycerine. It is due to decomposition of borax by glycerine with the formation of boric acid and glyceryl borate. So though borax is incompatible with alkaloids like cocaine, glycerine boracis can be mixed with them. As glycerine boracis contains free boric acid, it cannot be given with any alkaline preparation.

Re

Sodii bicarb.	...	...	ʒii
Glyc. boracis	...	...	ʒi
Aq. rosæ	...	...	ad ℥i

Glycerine boracis is acid, while sodium bicarbonate is alkaline. So when these two are combined in a solution, effervescence takes place due to liberation of CO_2 gas.

Zinc sulphate when mixed with borax precipitates zinc borate.

Mucilage of acacia is precipitated by a concentrated solution of borax.

Alum and borax powder when mixed together liberate water of crystallization and so becomes moist. Solution of alum and borax will result in precipitate of aluminium borate.

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ALKALOIDS AND THEIR SALTS

[*List of important alkaloids.*—Solid alkaloids: aconitine, atropine, caffeine, cocaine, morphine and strychnine. Liquid alkaloid : pilocarpine.]

Most of the alkaloids are insoluble in water, but their official salts except quinine sulphate and pelletiarine tannate are usually soluble. The alkaloids can only be held in solution by dilute acids when a soluble salt is formed.

The solubility of the following common alkaloids should be remembered :—

Atropine, 1 in 500 — Caffeine, 1 in 80
Codeine, 1 in 80 — Morphine, 1 in 1000.
Strychnine, 1 in 7000.

As some of the alkaloids and their salts are poisonous, their incompatibilities should be remembered.

The alkaloids are incompatible with :—

(1) *Alkalies and alkaline solutions*—which will precipitate the free alkaloid unless there is sufficient water present to keep it in solution. We may take the following example.

Re

Quin. sulphas.	...	...	℥ss
Acid. sulphuric dil.	...	...	℥iss
Aquam	...	...	ad ℥vi

Here the alkaloid quinine is dissolved by the acid forming quinine bisulphate, a soluble salt.

Now if an alkali is mixed with such an alkaloidal solution, the acid will be neutralised and the insoluble free alkaloid thrown out, as in the following combination.

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Re

Quin. sulphas.	...	...	℥ss
Acid. sulphuric dil.	...	...	℥iss
Potass. acetas.	...	...	℥iss
Aquam	...	...	ad ℨvi

Quinine acetate is precipitated.

Re

Ferri et quin. citras		...	℥ss
Potass. citras.	...	...	℥i
Aquam	...	...	ad ℨvi

Here the alkaline potassium citrate precipitates the alkaloid (quinine) although the iron remains in solution.

If the precipitated alkaloid be poisonous, it may even cause death. In such cases, as the precipitate falls to the bottom, the first few doses do not contain any alkaloid and the patient will take the whole of the alkaloid in the last dose with fatal result. Examples.—

Re

Liq. arsenicalis	...	...	m. xx
Liq. strych. hydrochlor.		...	m. xx
Aquam	...	...	ad ℨvi

As liquor arsenicalis (Fowler's solution) is alkaline, the alkaloid strychnine will be separated and taken with the last dose with fatal result. If arsenic is to be prescribed along with the alkaloid strychnine, the acid preparation liquor arsenici hydrochlor, should be used.

Sodium arsenate is hydrolysed in solution and has an alkaline reaction and should also be treated as an alkali.

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Re

Sodii bicarb.	...	...	ʒi
Liq. strychninæ	...	...	ʒss
Inf. gentianæ co.	...	...	ad ℥vi

Sodium bicarbonate, being alkaline, will precipitate strychnine.

Re

Cocainæ hydrochlor.		...	grs. v
Borax	...	...	grs. v
Aquam	...	...	ad ℥vi

This prescription is incompatible as borax (sodium biborate) has an alkaline reaction.

[Boric acid is however not an alkali and if it is used instead of borax no precipitate will occur].

Re

Morphinæ hydrochlor.		...	ʒss
Potass. bicarb.	...	...	ʒss
Aquam	...	...	ad ℥vi

Morphine is precipitated by the alkaline carbonate.

Re

Liq. potassæ	...	...	ʒi
Tinct. hyoscyami	...	...	ʒiii
Aquam	...	...	ad ℥vi

Caustic alkalies decompose the solanaceous alkaloids (e. g. hyoscyamine, atropine and cocaine) and destroy their therapeutic usefulness. Liquor potassæ, which is a caustic alkali, should not be prescribed with tincture hyoscyami as is sometimes done.

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In some cases alkalies are intentionally combined with non-poisonous alkaloids e. g. tincture quininæ ammoniata. Here ammonia ought to precipitate the alkaloid quinine ; but the quinine is in fact dissolved in the excess of ammonia and so no precipitate occurs. When however water is added to tincture quininæ ammoniata, the alkaloid is at once precipitated as in the following prescription.

Re

Tinct. quin. am.	...	...	ʒvi
Aquam	...	...	ad ʒvi

So it is advisable to prescribe it with mucilage (½ dram per ounce). Tincture quininæ ammoniata may also be taken with ærated water, when no precipitate occurs, due to formation of a soluble carbonate with carbon dioxide.

(2) *Alkaline salicylates and benzoates*—also precipitate alkaloids.

Re

Quin. sulphate	...	...	ʒss
Acid. sulphuric.	...	...	ʒi
Sodii salicylas	...	...	ʒi
Aquam	...	...	ad ʒvi

The quinine sulphate, dissolved in the acid, reacts with the salicylate producing a bulky precipitate of quinine salicylate.

But if the acid is omitted from the above mixture and the alkaline tincture quininæ ammoniata is used instead of quinine muriate, no precipitate will occur.

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Re

Tinct. quin. am.	...	...	ʒii
Sodii salicylas	...	...	ʒi
Aquam	...	...	ad ℥vi

(3) *Tannic acid and tannin containing substances* (see list in p. 65) ;—

Tannic acid and tannin form insoluble tannates with alkaloids and are therefore used as antidote to alkaloidal poisoning. Most vegetable infusions (except those of quassia, calumba and chiretta) contain tannin and should not be given with alkaloids.

Re

Quin. sulphas	...	...	ʒss
Acid. sulphuric dil.	...	...	ʒi
Inf. rhei.	...	...	ad ℥vi

The tannin contained in the infusion of rhei will throw down tannate of quinine.

Re

Morphinæ sulphas	...	...	gr. ii
Tinct. catechu	...	...	ʒii
Inf. krameriæ	...	...	ad ℥vi

As both catechu and krameria contain tannin, tannate of morphine is precipitated.

Re

Tinct. digitalis	...	...	ʒi
Ferri et quin. cit.	...	...	ʒss
Aquam	...	...	ad ℥vi

Digitalis contains tannin and so tannate of quinine will be precipitated. This is often an intentional com-

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bination. In such cases the mixture should be shaken before use.

Acacia sometimes prevents the precipitation of alkaloids by tannin.

(4) *Iodine and iodides.*—When an alkaloid is mixed with iodide solution it is precipitated.

Re

Quin. sulphas.	...	...	℥ss
Acid. sulphuric. dil.	...	...	℥ss
Potass. iodid.	...	...	℥ss
Syr. ferri iodid.	...	...	ad ℥vi

The quinine will be precipitated from the mixture as iodide of quinine which becomes converted into red crystals of quinine iodosulphate.

Re

Ferri et quin. cit.	...	...	℥ss
Potass. iodid.	...	...	℥ss
Aquam	...	...	ad ℥vi

Insoluble hydriodide of quinine will be slowly precipitated. Ferri et quininæ citras is sufficiently acid to free some iodine which combines with quinine forming an insoluble salt.

Double iodides (composed of the iodide of a heavy metal e. g. mercuric iodide and the iodide of an alkali) e. g. Donovan's solution (liquor arsenii et hydrargyri iodidi) and Mayer's reagent (potassio-mercuric iodide) precipitate all alkaloids with the exception of caffeine and theobromine.

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Re

Quin. sulphas.	...	...	℥ss
Acid. hydrochlor. dil.		...	℥i
Donovan's soln.	...	...	℥i
Aquam	...	...	ad ℥vi

Quinine will be precipitated.

Re

Quin. sulphas.	...	...	℥ss
Acid. hydrobrom. dil.		...	℥i
Potass. iodid.	...	...	℥ss
Liq. bismuthi et am. cit.		...	℥ii
Aquam	...	...	ad ℥vi

A double iodide of quinine and bismuth (Dragendorff's reagent) is formed and precipitates quinine from the mixture.

Re

Liq. strych. hydrochlor.		...	m. xx
Potass. iodid.	...	...	℥ss
Hydrarg. perchlor.	...	...	gr. ½
Aquam	...	...	ad ℥vi

A precipitate of red mercuric iodide is formed which dissolves in excess to form a double iodide of mercury and potassium (potassio-mercuric iodide or Mayer's reagent) and the alkaloid strychnine is thrown down.

(5) *Bromine and bromides*—are also incompatible with alkaloids.

Re

Strychninæ hydrochlor.		...	gr. ⅓
Potass. bromide.	...	...	℥i
Aquam	...	...	ad ℥vi

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The mixture remains clear for some time, then crystals of bromides of strychnine are deposited. The whole of the strychnine may therefore be taken with the last dose and a prescription of this nature was the cause of death in a woman. This prescription is also an example of physiological incompatibility, as bromide and strychnine are antagonistic in their action.

Quinine is however often intentionally combined with dilute hydrobromic acid or bromides, as the hydrobromide of quinine is soluble in water and prevents the toxic symptoms of quinine.

(6) *Mercuric chloride* (*hydrarg. perchloride*)—precipitates most of the alkaloids forming insoluble double salts.

Re

Mercuric chloride	...	...	gr. $\frac{1}{5}$
Liq. strychninæ hydrochlor.		...	m. xx
Aquam	...	...	ad ʒvi

Strychnine is precipitated as delicate acicular crystals.

(7) *Liquorice* (*ext. glycyrrhizæ liq.*)—

Re

Tinct. nucis vom.	...	...	ʒss
Ext. glycyrrhizæ liq.	...	...	ʒiii
Aquam	...	...	ad ʒvi

A precipitate (probably glycyrrhizinate of strychnine) is thrown down.

(8) *Most organic acids* (*except citric and acetic acids*)—are incompatible with almost all the alkaloids throwing down precipitates.

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Special Cases

Quinine.—

Quinine is an alkaloid and so its salts cannot be given with those substances which are incompatible with alkaloids. It is reprecipitated from its solution by alkalies and alkaline acetates, arsenates, benzoates, citrates, phosphates, salicylates and tartrates. The following combination was prescribed by an old medical practitioner of Calcutta, who apparently did not know that liquor arsenicalis being alkaline cannot be given with an acid quinine solution.

Re

Quin. sulphas.	...	grs. xii
Acid. sulphuric dil.	...	m. xxiv
Liq. arsenicalis	...	m. xxiv
Aquam	...	ad ℥vi

If arsenic is to be given in this quinine mixture, liquor arsenici hydrochlor. should be used instead of the alkaline Fowler's solution (liquor arsenicalis).

Re

Quinine sulphas.	...	℥i
Ammon. acetas.	...	℥i
Acid sulphuric dil.	...	℥i
Aquam	...	ad ℥vi

A bulky precipitate of quinine alkaloid is produced.

Alkaline carbonate, bicarbonate and spirit ammon. aromat. do not precipitate iron from scale preparations; but they precipitate the alkaloid quinine from iron and quinine citrate. Ferri et quinine citras contains excess of acid and so when it is mixed with an alkali there is effervescence and quinine alkaloid is thrown out.

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Like all alkaloids quinine is also precipitated by tannin, iodides and mercuric chloride.

Unlike other alkaloids quinine is intentionally prescribed with hydrobromic acid to prevent cinchonism.

Picric acid also precipitates quinine and is used as a test for quinine in the urine.

Aspirin is not incompatible with quinine.

Caffeine.—

It is incompatible with the usual alkaloidal precipitants with the following exceptions :—

(1) Caffeine is not precipitated from its salts by alkalies, as it is more soluble in water (1 in 80) than most of the alkaloids.

(2) It may be prescribed with salicylate of sodium. [*N. B.* Caffeine citrate cannot however be given with sodii salicylas].

(3) It is not precipitated by double iodides (e. g. Donovan's solution etc.).

It may be noted here that *caffeine citrate* is acid and easily dissociates in water setting free citric acid. So this salt of caffeine cannot be prescribed with benzoates, salicylates, iodides and other substances incompatible with acids.

℞

Caffeine citrate	...	ʒi
Potassium iodide	...	ʒi
Aquam		ad ʒvi

Iodine will be liberated.

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Atropine and hyoscyamine.—

These are also incompatible with the usual alkaloidal precipitants with the following exceptions :—

(1) Atropine and hyoscyamine may be given with bicarbonates and ammonium carbonate, though not with the other alkalies.

Re

Liq. ammon. citras.	...	ʒvi
Spt. ammon. aromat.	...	ʒi
Tinct. bellad.	...	ʒi
Aquam	...	ad ʒvi

No precipitate will be formed.

(2) They are physiologically incompatible with certain alkaloids e. g, morphine, pilocarpine and physostigmine and so should not be given with them.

(a) Atropine and morphine.—

Region of the body	Atropine	Morphine
Respiratory centre ...	Stimulated ...	Depressed.
Cerebral centres ...	Stimulated ...	Depressed.
Intestines ...	Peristalsis stimulated ...	Peristalsis depressed.

But though morphine and atropine are physiologically incompatible they are intentionally combined to counteract the bad effects of morphine.

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(b) Atropine and pilocarpine.—

Effect on	Atropine	Pilocarpine
Secretions	Inhibited ...	Increased.
Eye	Causes dilatation of the pulpils due to paralysis of the terminations of the third nerve in the iris and ciliary muscles.	Causes contraction of the pupils (i. e. a myotic) due to stimulation of the terminations of the third nerve.

(c) Atropine and physostigmine.—

Effect on	Atropine	Physostigmine
Salivary secretions ...	Inhibited ...	Increased
Pupils	Causes dilatation of the pupils.	Causes contraction of the pupils.
Respiratory centres	Stimulated ...	Depressed almost from the beginning.

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TANNIC ACID

Tannic acid is incompatible with the following substances :—

(1) *Alkaloids*—which are mostly thrown down as tannates.

Re

Strychninæ hydrochlor.	...	gr. 1/6
Acid tannic	...	grs. xxx
Aquam	...	ad ʒvi

Strychnine will be thrown down as a white precipitate.

(2) *Salts of heavy metals*, such as antimony tartrate, bismuth, ferric salts, lead acetate and salts of gold and silver. When tannin is mixed with ferric salts, a blue black colour or precipitate will result.

(3) *Alkalies.*—When tannic acid is mixed with alkalies e. g. lime water, soluble tannates are formed, but in a short time there is change of colour in the solution which may even turn black.

(4) *Mineral acids.*—When mixed with mineral acids tannic acid is precipitated by a process somewhat similar to that of salting out of soap.

Spirit ætheris nitrosi, if acid, cannot be given with tannic acid, because gaseous compounds of nitrogen are liberated.

(5) Albumin, starch, gelatin and most glucosides.

Albuminous substances form insoluble albumin tannate with tannic acid.

(6) Phenazone.

(7) Liquid iodine—is decolorised by tannic acid.

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Substances Containing Tannin.—

The following substances contain tannin :—

Catechu, cascarilla, cimicifugæ, cinchona, cinnamomi, digitalis, ergot, hammamelidis, hæmatoxylin, vegetable infusions (except quassia, calumba and chiretta), ipecacuanha, kino, krameria and rhubarb.

These tannin containing substances are *incompatible with* :—

(1) *Alkaloids.*—Substances containing tannin should not be given with alkaloids.

(2) *Salts of heavy metals.*—

Re

Tinct. ferri perchlor.	...	ʒi
Tinct. catechu	...	ʒi
Aquam	...	ad ʒvi

A dark greenish precipitate will be formed.

Digitalis.—

As digtialis contains tannin, it is incompatible with alkaloids and metallic salts. But it is often prescribed intentionally with quinine (an alkaloid) and tincture ferri perchlor.

Re

Tinct. digitalis	...	ʒi
Ferri et quin. cit.	...	ʒi
Aquam	...	ad ʒvi

Tannate of quinine will be precipitated (intentional incompatibility).

Re

Tinct. digitalis	...	ʒi
Tinct. ferri perchlor.	...	ʒi
Aquam	...	ad ʒvi

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The mixture will turn muddy and green due to the formation of tannate of iron. This combination is often intentional. In such cases, it is better to add one dram of dilute acid phosphoric (10 minims per dose) which will make the mixture clear and change the colour to light yellow. In place of the tannate of iron there will be precipitate of phosphate of iron, which is soluble in excess of the phosphoric acid.

BISMUTH

Bismuth Subnitrate.—

Bismuth subnitrate is insoluble in water (physical incompatibility); and so in most cases it is suspended by means of pulv. tragacanth compound.

When suspended in water, it renders the water *acid in reaction* due to formation of basic nitrate and free nitric acid; so it *should not be given with substances incompatible with acids* e.g. alkalies, iodides etc.

(1) Alkalies.—

Re

Bismuth subnitras.	...	ʒi
Sodii bicarb.	...	ʒi
Aquam	...	ad ʒvi

In this prescription bismuth subnitrate will slowly decompose the alkaline bicarbonate and evolve carbon dioxide gas. The bottle may even burst after being put aside for some time.

Chalk mixture contains calcium carbonate and so when mixed with bismuth subnitrate will cause effervescence.

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(2) Iodides.—

Re

Bismuth subnitras.	...	ʒi
Sodii iodid.	...	ʒi
Aquam	...	ad ʒvi

The mixture becomes yellow due to liberation of free iodine and formation of bismuth iodide.

(3) *Tannic acid and tannin containing substances*—form insoluble yellow tannate of bismuth with bismuth subnitrate in presence of water.

(4) *Glycerine*—probably forms nitroglycerine and there is risk of explosion.

(5) *Sulphur*—forms precipitate of bismuth sulphide.

(6) *Mucilage of acacia.*—With acacia bismuth subnitrate forms a compact mass at the bottom of the bottle and hence pulv. tragacanth compound is used for suspending it.

Liquor Bismuthi et Ammonii Citras.—

This is an *alkaline* preparation and is incompatible with all substances which cannot be mixed with alkalies e. g. acids, alkaloids, iron salts etc.

(1) *Mineral acids.*—

Re

Liq. bismuthi et ammon. cit.		ʒii
Acid. sulphuric dil.	...	ʒi
Aquam	...	ad ʒvi

Bismuth citrate is precipitated.

(2) *Substances containing tannin*—form tannate of bismuth when mixed with liq. bismuthi.

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Re

Liq. bismuthi et ammon. cit.		ʒiii
Inf. rhei	...	ad ℥vi

Tannate of bismuth is precipitated.

(3) *Alkaloids.*—When liq. bismuthi is mixed with potassium iodide a double iodide is formed which precipitates most of the alkaloids.

Bismuth Salicylate.—

It is insoluble in water and alcohol; and is usually prescribed as a powder, but may be given as a mixture suspending it with mucilage of acacia.

Bismuth salicylate is incompatible with—

(1) *Carbonates.*—Sodium bicarbonate in a mixture with bismuth salicylate will cause effervescence.

(2) *Ferric salts*—will produce a violet colour.

MAGNESIUM SULPHAS

Magnesium sulphate is incompatible with :—

(1) *Alkaline substances.*—

Re

Mag. sulphas	...	ʒiii
Sodii carb.	...	ʒiss
Aquam	...	ad ℥vi

Magnesium carbonate is precipitated.

Exceptions :—

Magnesium sulphate may however be given with the following alkaline substances.—

(a) Sodii or potass. bicarbonas.—

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Re

Mag. sulphas.	...	ʒiii
Sodii bicarb.	...	ʒiss
Aquam	...	ad ʒvi

No precipitate is formed.

(b) Ammonium carbonate and liquor ammoniæ.

(2) *Sodii phosphas.*—

Re

Mag. sulphas.	...	ʒiii
Sodii phosphas.	...	ʒiii
Aquam	...	ad ʒvi

A thick flocculent precipitate of magnesium phosphate is formed.

(3) *Lead acetate.*—

Re

Plumbi acetas.	...	grs. xx
Mist. sennæ co.	...	ad ʒvi

Mist. sennæ co. contains magnesium sulphate; so a precipitate of lead sulphate will be formed.

———

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IRON

Ferrous Salts.—

These salts are incompatible with :—

(1) *Tannic acid and all substances containing tannin* (see p. 65).—

These form a blue *black* precipitate with ferrous salts due to precipitation of tannate of iron (i.e. ink). All vegetable decoctions, extracts, infusions etc. (except quassia, calumba and chiretta) contain tannin and are incompatible with iron salts. So only quassia, calumba and chiretta can be prescribed along with iron.

Gentian does not contain any tannin, but still it cannot be given with iron because the colouring matter is darkened by it.

(2) *Gallic acid.*—It produces blue black precipitate with ferrous salts.

(3) *Alkalies.*—The soluble salts of iron are incompatible with the soluble, that is the alkaline carbonates, hydroxides and phosphates, as insoluble carbonates, hydroxides or phosphates of iron are formed and thrown down from the solution. The alkalies give *green* precipitate *with ferrous* (and *brown with ferric*) salts.

We shall now give here a few examples of intentional combination of iron salts with alkaline solutions.

(i) Mist. ferri composita (Griffith's mixture).—In this B. P. preparation ferrous sulphate and potassium carbonate are intentionally combined resulting in the precipitation of green ferrous carbonate.

$$Fe\,SO_4 + K_2\,CO_3 = Fe\,CO_3 + K_2\,SO_4$$

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(ii) Blaud's pill (pilula ferri).—

Here ferrous sulphate is intentionally combined with sodium carbonate with the object of precipitating ferrous carbonate. The same change takes place as in mist. ferri composita.

Ferrous salts are converted to ferrric salts when exposed to the air.

Scale Preparations of Iron.—

The scale preparations of iron, e. g. ferri et ammon. citras and ferri et potassi tartras are not precipitated by alkaline preparations.

Re

Ferri et ammon. cit.	...	ʒss
Ammon. carb.	...	ʒss
Aquam	...	ad ʒvi

The solution will be clear.

Ferri et quininæ citras. is the only scale preparation which cannot be given with any alkali.

Re

Ferri et quin. cit.	...	ʒi
Sodii bicarb.	...	ʒi
Inf. quassia	...	ad ʒvi

Ferri et quininæ citras, being acid in reaction, reacts with the bicarbonate of sodium. The result is effervescence and precipitation of quinine from the solution,

Syrup of Ferrous Iodide.—

Syrup of ferrous iodide contains both iron and iodide.

As it contains iron it is incompatible with—

(a) Tannic acid and tannin containing substances.

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(b) Gallic acid.

(c) Alkaline carbonates, bicarbonates, alkaline salts and ammonium hydroxide.

Re

Syr. ferri iodid.	...	ʒi
Liq. arsenicalis	...	ʒss
Aquam	...	ad ʒvi

A precipitate of ferrous carbonate is formed.

As it contains iodide it is incompatible with—

(a) Acids and acid solutions.

(b) Alkaloids.—When syrup of ferrous iodide is mixed with syrup of phosphate of iron with quinine and strychnine, iodides of the alkaloid are precipitated.

(c) Oxidizing agents.—

Re

Syr. ferrous iodid.	...	ʒiv
Potass. chloras	...	ʒii
Aquam	...	ad ʒvi

The ferrous iodide is oxidized with gradual liberation of iodine.

Ferric Chloride.—

It is incompatible with :—

(1) *Tannin-containing substances,* with which it produces an intense *black* precipitate of tannate of iron (ink).

Re

Tinct. ferri perchlor.	...	ʒii
Ext. cinchonæ liq.	...	ʒii
Aquam	...	ad ʒvi

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Cinchona contains tannin ; so a precipitate will be formed.

Re

Tinct. ferri perchlor.	...	ʒii
Tinct. digitalis	...	ʒii
Aquam	...	ad ʒvi

Digitalis contains tannin ; tannate of iron will therefore be precipitated and the mixture will turn black. But these drugs are often combined intentionally. In such cases the mixture is generally clarified with a little dilute phosphoric acid.

(2) *Alkalies*—give *brown* precipitate with ferric salts.

Alkaline hydroxides form precipitate of ferric hydroxide. It may be prevented by citrates or tartrates.

The following preparation is an example of intentional incompatibility.

Mist. ferri ammoniata B. P. C.—

Re

Liq. ferri perchlor.	...	ʒi
Spt. ammon. aromat.	...	ʒi
Syr. simplex	...	ʒii
Aq. dest.	...	ad ʒvi

This is an intentional combination. If the prescription is dispensed in the order given, there will be a precipitate of ferric hydrate when liq. ferri perchlor. is mixed with spt. ammon. aromat. But if the mixture is dispensed in the following way there will be no such precipitate. Liquor ferri perchlor. should be mixed with the syrup and half the water, and the spirit ammon. aromat. separately with the remainder of the water ; and then the two solutions mixed together.

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(3) *Acetates*—which produce blood *red* colour due to formation of ferric acetate. This is an intentional combination and is known as Basham's mixture. It should be dispensed with a 'Shake the Bottle' label.

(4) *Benzoates*—produce a flesh coloured precipitate.

(5) *Salicylates*—which give a deep purple *red* colour of ferric salicylate. Salol also produces similar colour.

(6) *Arsenates*—produce a precipitate.

(7) *Phosphates*—precipitate ferric phosphate which however can be prevented by the addition of alkaline citrates or tartrates.

Hypophosphites—also form a precipitate.

(8) *Potassium iodide.*—When potassium iodide is mixed with solution of ferric chloride, the colour of the mixture changes to dark brown and later on crystals of iodine are deposited. Such a mixture should not be dispensed.

(9) *Tincture opium* gives a *red* colour of ferric meconate which is harmless.

(10) *Carbolic acid* in aqueous solution produces a *violet* colour.

Re

Liq, ferri perchlor.	...	ʒiii
Acid. carbolic liq.	...	ms.xx
Aquam	...	ad ʒvi

(11) With *phenazone* (antipyrine) or *phenacetin* a deep *red* colour is produced.

(12) *Acetanilide* gives a *red* colour only in alcoholic solution.

(13) *Gallic acid*—produce blue-black colour.

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MERCURY

Hydrargyri Perchloridum (Mercuric Chloride, Corrosive Sublimate).—

Mercuric chloride is incompatible with so many substances that it is better given alone or in known combination.

Incompatibles ;—

(1) *Alkalies.*—

If arsenic is to be given with mercuric chloride, liquor arsenici hydrochlor. should be used and not the alkaline liq. arsenicalis.

When borax (sodium biborate) is combined with mercuric chloride, red oxychloride of mercury is precipitated.

In some cases however mercuric chloride is combined intentionally with alkaline solutions, as for example :—

Lotio hydrargyri flava (yellow wash).—

Re

Hydrarg. perchlor.	...	grs. 40
Lime water	...	pint 1

$$Hg\,Cl_2 + Ca\,(OH)_2 = HgO + Ca\,Cl_2 + H_2O$$

(2) *Ammonia.*—When ammonia is mixed with mercuric chloride there is precipitation of ammoniated mercury (mercuric chloramide or white precipitate).

Recently we found a local medical practitioner prescribing the following mixture to a boy suffering from typhoid fever.

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Re

Liq. ammon. cit.	...	ʒvi
Spt. ammon. aromat.	...	ʒi
Pot. citras.	...	ʒi
Liq. hydrarg. perchlor	...	ʒi
Aq. chlorof.	...	ad ʒvi

Poisonous ammoniated mercury is formed.

So the treatment was worse than the disease itself.

Hydrargyrum ammoniatum (white precipitate)—is an example of intentional incompatibility.

This is prepared by mixing solutions of mercuric chloride and ammonia. The reaction is as follows :—

$$HgCl_2 + 2NH_4OH = NH_2HgCl + NH_4Cl + 2H_2O$$

Mercuric chloride — Ammonia — Hydrarg. ammoniata

(3) *Alkaloids.*—Alkaloidal salts are generally precipitated by it.

(4) *Iodides.*—When potassium iodide is mixed with mercuric chloride, a precipitate of red iodide of mercury is at first formed ; but as the precipitate descends in the water it becomes redissolved. This is due to the fact that the precipitated red iodide which is insoluble in water, is soluble in a solution of potassium iodide—a soluble double salt, the iodide of mercury and potassium (biniodide of mercury) being formed. The following prescription is used intentionally.

Re

Liq. hydrarg. perchlor.	...	ʒi
Potass. iodide.	...	ʒss
Aquam	...	ad ʒvi

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Biniodide of mercury (hydrargyri iodidum rubrum) is prepared by mixing solutions of mercuric chloride and potassium iodide, when the red iodide is precipitated.

The following mixture cannot be dispensed in the order given as, if liq. hydrarg. perchlor. is mixed with the alkaline ammon. carb., the mercury will be precipitated.

Re

Liq. hydrarg, perchlor.	...	ʒi
Ammon. carb.	...	ʒss
Potass. iodid	...	ʒss
Aquam	...	ad ʒvi

The mixture can however be dispensed if the perchloride and potassium iodide are first mixed together and the ammon. carb, is added last of all. When potassium iodide is mixed with the perchloride, the result is the formation of soluble biniodide of mercury, which can be combined with the alkaline carbonate without risk of formation of any precipitate.

(5) *Bromides*—form precipitate of white mercuric bromide which is soluble in excess of bromide or hydrarg. perchloride.

(6) *Iron.*—Steel instruments should not be sterilised in hydrarg. perchloride lotion.

(7) *Lead and silver salts.*

(8) *Sulphur*—produces mercuric sulphide.

(9) *Tannic acid and vegetable astringents containing tannin*—form a precipitate.

(10) *Albumin*—is precipitated ; but it may be prevented by sodium chloride.

Hydrargyri Subchloridum (Calomel).—

Calomel is rather easily oxidized to corrosive sublimate, a more toxic substance.

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Lime water is intentionally mixed with calomel to precipitate black mercurous oxide in the preparation of black wash.

Sodium bicarbonate can also be given with calomel.

If calomel is mixed with *ammonium carbonate*, black precipitate of mercury is formed.

Cocaine hydrochlor.—forms mercuric chloride.

It is decomposed by *potassium iodide* with the formation of yellow mercurous iodide. Calomel should not therefore be used even externally when free iodine or its preparations are being administered.

With tincture of iodine, red iodide of mercury is precipitated. Iodoform is also decomposed by calomel.

Calomel is decomposed by potassium *bromide* in the presence of a trace of moisture resulting in the formation of a poisonous mercuric chloride and metallic mercury.

Sulphur—produces black sulphide of mercury.

ARSENIC

Acid Arsenious.—

It is incompatible with lime water, salts of iron and magnesia.

Liquor Arsenicalis (Fowler's Solution).—

Liquor arsenicalis being alkaline in reaction should not be given with any substance incompatible with alkalies, such as :—

(1) *Acid solutions.*

(2) *Alkaloids.*—

Re

Liq. arsenicalis	...	℥ss
Liq. strych. hydrochlor.	...	℥ss
Aquam	...	ad ℥vi

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The alkaline liq. arsenicalis will precipitate the alkaloid strychnine. It may be mentioned that the reaction of liq. strychninæ hydrochlor. is acid and so in that respect also it is incompatible with liq. arsenicalis.

(3) *Preparations of iron.*—

Being alkaline liq. arsenicalis cannot be prescribed with iron salts except the scale preparations (ferri et ammon. cit. and ferrum tartaratum).

(4) *Hydrarg. perchlor.*—

As liq, arsenicalis is alkaline, it precipitates mercuric oxide when given with mercuric chloride.

The following prescription is however correct because it contains in fact a double iodide of mercury and potassium which is compatible with alkalies.

Re

Liq. hydrarg. perchlor.	...	℥i
Potass. iodid.	...	℥i
Liq. arsenicalis	...	ms. xx
Aquam	...	ad ℥vi

Liq. Arsenici Hydrochlor.—

This preparation is *acid* in reaction. So when arsenic is to be given with acid solution or any alkaloid, it is used instead of the alkaline liq. arsenicalis.

The following prescription is correct.

Re

Quin. sulphas.	...	℥i
Acid. sulphuric dil.	...	℥ii
Liq. strych. hydrochlor.	...	ms. xx
Liq. arsenici hydrochlor.	...	ms. xxiv
Aquam	...	ad ℥vi

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The prescription given below is wrong because ammonia is an alkali while liq. arsenici hydrochlor, is acid.

Re

Liq. ammon. cit.		ʒvi
Spt. ammon aromat.	...	ʒi
Liq. arsenici hydrochlor.	...	ʒss
Aquam	...	ad ʒvi

Liq. Arsenii et Hydrargyri Iodidi (Donovan's Solution).—

This preparation is alkaline in reaction and is therefore incompatible with acids and precipitates all alkaloids with the exception of caffeine and theobromine.

SODIUM SALICYLATE

It is incompatible with.

(1) *Acid solutions.*—Salicylates are decomposed by mineral acids with the precipitation of salicylic acid in the form of needles.

Re

Sodii salicylas	...	ʒi
Acid. sulphuric dil.	...	ʒi
Aquam	...	ad ʒvi

Salicylic acid will be precipitated.

Rs

Caffeine citras.	...	ʒi
Sodii salicylas	...	ʒii
Aquam	...	ad ʒvi

When caffeine citrate is mixed with water, it is dissociated with formation of caffeine and citric acid. If it is prescribed with sodium salicylate the free citric acid will precipitate

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salicylic acid. If however the alkaloid caffeine is used in the above prescription instead of caffeine citras there will be no precipitate. Only half the weight of caffeine should be used as caffeine citrate is prepared from equal weight of the alkaloid and citric acid.

(2) *Ferric salts.*—

Re

Liq. ferri perchlor.	...	℥i
Sodii salicylas.	...	℥i
Aquam	...	ad ℥vi

The mixture will turn purple and a precipitate of basic ferric salicylate may be formed.

If however in the above mixture ferri et ammon. citras. or ferrum tartaratum be used instead of liq. ferri perchlor. no precipitate will be formed. Scale preparations of iron do not give rise to any precipitate when combined with sodium salicylate.

(3) *Alkaloids*—are precipitated by salicylates.

Quinine salts form insoluble salicylate of quinine with salicylates.

Re

Sodii salicylas	...	℥i
Quin. sulphas.	...	℥ss
Acid. sulphuric dil.	...	℥ss
Aquam	...	ad ℥vi

A thick precipitate of quinine salicylate is formed.

(4) *Phenacetin* and *acetanilide*—both form paste with salicylic acid.

(5) *Spirit ætheris nitrosi*—produces a yellow colour changing to red with salicylates.

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IODIDES

Iodides are incompatible with—

(1) *Acid solutions.*—

Mineral acids and acid solutions decompose iodides liberating free iodine, which may be detected by starch or by the rose red colour imparted to chloroform when agitated with the mixture.

Re

Tinct. ferri perchlor.	...	ʒi
Potass. iodid.	...	ʒss
Aquam	...	ad ʒvi

As tinct. ferri perchlor. is acid in reaction the iodide will be decomposed and the mixture will turn dark brown with separation of crystals of iodine later on.

$$2FeCl_2 + 2KI = 2FeCl_2 + 2KCl + I_2$$

Ferri et ammon. cit. and ferrum tartaratum may be given with potassium iodide. But ferri et quiniæ cit. cannot be given in this way.

Spirit ætheris nitrosi, when kept for a long time, sometimes becomes acid and such preparations decompose iodides liberating iodine.

Re

Potass. iodid.	...	ʒss
Spt. ætheris nitrosi	...	ʒii
Aquam	...	ad ʒvi

Iodine is liberated. If however the spirit of nitrous ether is previously made neutral by the addition of an alkali

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such as ammonium carbonate or potassium bicarbonate, no decomposition will occur.

Re

Potass. iodid.	...	ʒi
Bissmuth subnit.	...	ʒii
Aquam	...	ad ʒvi

Bismuth subnitrate being acid in reaction this mixture becomes yellow due to formation of free iodine and bismuth iodide.

Aspirin (acetyl-salicylic acid) also decomposes iodides liberating iodine.

(2) *Alkaloids*—are precipitated by iodides.

Re

Quin. bihydrochlor.	...	ʒss
Potass. iodid.	...	ʒi
Inf. quassiæ	...	ad ʒvi

Quinine iodide is precipitated.

(3) *Oxidising agents.*—

Re

Syr. ferri iodid.	...	ʒiv
Potass. chloras.	...	ʒii
Aquam	...	ad ʒvi

The chlorate is reduced to chloride and after a few days iodine is set free from the ferrous iodide and is deposited as crystals. This prescription was the cause of death of a child.

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(4) *Mercury.*—

When mercuric chloride is mixed with potassium iodide, red iodide of mercury is thrown down. But this precipitate is dissolved by the excess of potassium iodide with the formation of a colourless solution of double iodide (HgI_2 2K I). The following mixture is a favourite combination.

Re

Potass. iodid.	...	ʒi
Hydrarg. perchlor.	...	gr. i
Aquam	...	ad ʒvi

The iodide should be first dissolved in the water and mercuric chloride then added to it.

Calomel (mercurous chloride) is decomposed by potassium iodide with the formation of yellow mercurous iodide. When a patient is taking potassium iodide, calomel should not be given to him. Violent irritation of the eye has been known to occur from the application of calomel to the eye of a patient undergoing iodide treatment.

(5) Paraldehyde—liberates iodine.

(6) Chloral hydrate.

BROMIDES

Incompatible with :—

(1) *Strong mineral acids.*

(2) *Alkaloids.*—

Re

Potas. bromid.	...	ʒss
Liq. strych. hydrochlor.	...	ʒss
Aquam	...	ad ʒvi

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Bromide of strychnine is deposited after some time.

Quinine is however sometimes intentionally prescribed with dilute hydrobromic acid and bromides, because the hydrobromide of quinine is soluble in water and prevents cinchonism.

(3) *Strong oxidising agents.*

(4) *Calomel and salts of lead and silver.*—

When calomel (mercurous chloride) is mixed with potassium bromide, it is decomposed and turned black.

Re

Hydrarg. subchlor.	...	grs. iii
Potass. bromid.	...	grs. x

There is separation of metallic mercury and formation of a poisonous double salt, mercuric potassium iodide.

CHLORAL HYDRATE

Chloral hydrate is liable to be decomposed readily and is incompatible with the following substances.

(1) *Alkalies.*—

When chloral hydrate is mixed with alkalies, chloroform is liberated.

Re

Chloral hydrate	...	ʒi
Ammon. carb.	...	ʒi
Aquam	...	ad ʒvi

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Chloral hydrate is decomposed by the alkaline carbonate of ammonia with liberation of chloroform. No precipitate is formed, but still the mixture is useless as some part of the medicine is evaporated.

(2) *Iodides and bromides*—should not be given with chloral hydrate in a mixture containing a tincture as in presence of alcohol an oily layer of chloral alcoholate is produced.

(3) *Antipyrine* (phenazone), *sulphonal, acetanilide and camphor.*—

(a) Phenazone.—

Re

Phenazone	...	ʒi
Chloral hydras.	...	ʒi
Aquam	...	ad ʒvi

An insoluble oily compound of phenazone and chloral is formed at the bottom of the bottle.

(b) Sulphonal.—If chloral hydrate is given with sulphonal in powder form, the powder will become soft. This is an example of physical incompatibility.

Re

Chloral hydras.	...	grs. x
Sulphonal	...	grs. x

A soft pasty mass is formed.

(c) Acetanilide (antifebrin)—forms a paste with chloral hydrate (physical incompatibility).

(d) Camphor—forms a liquid with chloral.

(4) *Carbolic acid.*

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(5) *Alcohol.*

(6) *Potassium permanganate*—oxidizes chloral hydrate.

ASPIRIN

Aspirin or acetyl-salicylic acid is incompatible with the following substances :—

(1) *Water.*—Aspirin is decomposed in contact with water into acetic and salicylic acids. It is therefore better to prescribe it dry in powders or tablets. Such powders or tablets should not smell of acetic acid which indicates decomposition.

[*N. B.* Calcium, lithium and magnesium salts of acetyl-salicylic acid are however soluble in water and may be given in solution].

(2) *Alkalies*—decompose aspirin forming acetates and salicylates. Carbonates set free carbon dioxide.

(3) *Potassium iodide*—is decomposed by aspirin with liberation of iodine.

Re

Potass. iodid.	...	grs. v
Acetyl-salicylic acid	...	grs. v

M. Ft. Pulv. Put in cachets.

After a few days the powder becomes bluish black in colour. This is due to the decomposition of the iodide resulting in the liberation of iodine. Cachets are made of starch and so the iodine thus liberated combines with the starch and causes change in colour.

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(4) *Hexamine* (urotropine).—A powder containing aspirin and and hexamine becomes almost a liquid mass in a few days. The colour changes to greenish yellow and there is an odour of formalin.

(5) *Quinine.*—

Powders, containing aspirin and quinine, if kept for a few days, decompose with the formation of salicylic acid.

Aspirin may however be safely given with quinine sulphate in a mixture. Aspirin (acetyl-salicylic acid) dissolves the quinine producing quinine acetyl-salicylic, which is soluble in water.

SPIRIT ÆTHERIS NITROSI

Spirit of nitrous æther is neutral when pure, but becomes acid in presence of moisture. There is hydrolysis of ethyl nitrite on keeping, with the result that the spirit contains free nitrous acid. This fact should be remembered when it is prescribed, as a preparation that is acid in reaction will be incompatible with substances which cannot be given with acids. In most cases the incompatibility can be prevented by neutralising it with a little potassium carbonate.

Specimens of spt. ætheris nitrosi, which are *acid in reaction,* are incompatible with :—

(1) *Alkalies*—which cause hydrolysis of spt. ætheris nitrosi.

Spt. ætheris nitrosi is however often intentionally prescribed with liq. ammon. acetatis, an alkaline preparation,

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Re

Liq. ammon. acet.	...	℥vi
Spt. ætheris nitrosi	...	℥iss
Aquam	...	ad ℨvi

If the specimen of spt. ætheris nitrosi be acid, the nitrous acid present in it will combine with the ammonia and form ammonium nitrite. As the product is equally useful the mixture is used intentionally.

If however the spt. ætheris nitrosi is previously neutralised with potassium carbonate there will be no such reaction.

(2) *Substances containing tannin*— which decompose the nitrite liberating explosive gaseous compounds of nitrogen.

(3) *Iodides.*—Spt. ætheris nitrosi sets free iodine from the iodide.

Re

Spt. ætheris nitrosi	...	℥ii
Potass. iodid.	...	℥ii
Aquam	...	ad ℨvi

Iodine is liberated.

If however the mixture contains an alkali such as bicarbonate of potassium there will be no such change and it may then be safely dispensed.

(4) *Sodium salicylate.*—A distinctly acid preparation of spt. ætheris nitrosi will precipitate salicylic acid. But ordinarily it does no harm and merely changes the colour of the mixture to yellow or red. This effect may be retarded but not prevented by neutralising the spirit.

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(5) *Minor colour reactions.*—

(a) With *morphine*—a *yellow* colour is produced.

(b) When mixed with *antipyrine* (*phenazone*)—the latter is converted into nitroso-antipyrine by the free nitrous acid in the spt. ætheris nitrosi. The colour of the mixture becomes brilliant *green.* This reaction is used as a test for phenazone. It may be avoided by prescribing these two drugs in an alkaline solution.

(c) *Acetanilide*—gives a *yellow* colour.

(d) *Guaiac*—produces a *blue to red* colour.

(e) With *carbolic* acid, a *yellow to red* colour is formed.

(f) *Resorcin*—gives a dark *red* colour.

ACACIA

Acacia is incompatible with the following substances :—

(1) *Preparations containing alcohol.*—

Acacia is insoluble in alcohol and a precipitate is formed on mixing them. In an emulsion however alcoholic preparations, such as tinctures, spirits, liquors, alcoholic extracts etc., are much diluted and so no precipitate is formed. When dispensing an emulsion it should be first diluted and the tinctures, spirits etc. added to it last of all.

(2) *Borax* (sodii biborate).—When a strong solution of borax is mixed with acacia a gelatinous precipitate is produced.

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(3) *Ferric salts* (per salts of iron).—

Re

Liq. ferri perchlor.	...	ʒii
Mucilage acacia	...	ʒi
Aquam	...	ad ʒvi

A precipitate of ferric arabate will be formed.

Dialysed iron also forms a red gelatinous mass. Ferrous salts however do not coagulate mucilage of acacia.

(4) *Acids.*—Sulphuric acid produces a precipitate.

Nitric acid also decomposes acacia.

(5) *Solution of lead subacetate* (not acetate).—

Re

Liq. plumbi subacetas	...	ʒii
Muc. acacia	...	ʒi
Aquam	...	ad ʒvi

A white precipitate ol lead arabate will be formed.

No precipitate is however formed with lead acetate.

(6) *Guaiacum.*—Tincture of guaiacum produces blue colour when mixed with acacia.

———

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EXERCISES IN INCOMPATIBILITY

[*N. B. For answers see the next chapter*]

(1)	Re	Sodii bicarb.	...	ʒss
		Spt. ammon. aromat.	...	ʒi
		Bismuth subnitras.	...	ʒii
		Aquam	...	ad ℥vi
(2)	Re	Ol. morrhue	...	ʒvi
		Liq. arsenicalis	...	ms.xxiv
		Muc. acaciæ	...	ʒss
		Syr. ferri iodid.	...	ʒiii
		Aq. chlorof.	...	ad ℥vi
(3)	Re	Potass. iodid	...	ʒi
		Tinct. lobeliæ æther.	...	ʒi
		Sodii nitritis	...	grs. xii
		Syr. limonis	...	ʒiii
		Aquam	...	ad ℥vi
(4)	Re	Calcii chlorid.	...	ʒi
		Sodii sulphas.	...	ʒvi
		Aquam	...	ad ℥vi
(5)	Re	Potass. citras.	...	ʒi
		Vin. ipecac.	...	ms. xv
		Syr. tolu	...	ʒiii
		Inf. rosæ	...	ad ℥vi
(6)	Re	Aspirin	...	grs. v
		Quin. sulphas.	...	grs. v
		M. ft. pulv. i		

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(7)	Re	Liq. hydrarg. perchlor.	...	℥vi
		Spt. ammon. aromat.	...	℥ii
		Potass. iodid.	...	℥ss
		Ext. sarsæ liq.	...	℥ii
		Aquam	...	ad ℨvi
(8)	Re	Bismuth subnitras.	...	℥i
		Tinct. cannabis ind.	...	℥i
		Aq. anisi	...	ad ℨvi
(9)	Re	Potass. permang.	...	gr i
		Glycerine	...	q.s
		M. ft. pil. i	...	
(10)	Re	Cocainæ hydrochlor.	...	grs. vi
		Glyc. acid. carbolic	...	ms. xii
		Boracis	...	℥ii
		Aquam	...	ad ℨi
(11)	Re	Aluminis	...	℥ss
		Liq. plumbi subacet. dil.	...	℥ss
		Muc. acaciæ	...	℥i
		Aquam	...	ad ℨvi
(12)	Re	Ammon. carb.	...	℥ss
		Potass. bicarb.	...	℥ss
		Syr. scillæ	...	℥vi
		Aq. cinnamomi	...	ad ℨvi
(13)	Re	Hydrarg. perchlor.	...	gr. i
		Liq. arsenicalis	...	℥ss
		Potass. iodid.	...	℥i
		Inf. cinchonæ	...	ad ℨvi
(14)	Re	Silver nitrate	...	grs. v
		Sodii chlorid.	...	grs. v
		Aq. dest.	...	ad ℨi

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(15)	Re	Liq. ammon. cit.	...	ʒvi
		Tinct. quin. ammon.	...	ʒvi
		Sodii salicylas.	...	ʒi
		Aquam	...	ad ℥vi
(16)	Re	Potass. bicarb.	...	ʒi
		Potass. chloras.	...	ʒi
		Glyc. aluminis	...	ʒi
		Aquam	...	ad ℥vi
(17)	Re	Bismuth subnitras.	...	ʒii
		Sodii bicarb.	...	ʒii
		Muc. acaciæ	...	q.s.
		Tinct. catechu	...	ʒii
		Aquam	...	ad ℥vi
(18)	Re	Tinct. ferri perchlor.	...	ʒii
		Diuretin	...	ʒss
		Syr. limonis	...	ʒii
		Aquam	...	ad ℥vi
(19)	Re	Zinci sulphas.	...	grs. ii
		Boracis	...	grs. viii
		Aq. dest.	...	ad ℥i
(20)	Re	Tinct. digitalis	...	ʒi
		Tinct. ferri perchlor.	...	ʒi
		Tinct. cinch. co.	...	ʒii
		Aquam	...	ad ℥vi
(21)	Re	Antipyrin	...	grs. x
		Spt. ætheris nitrosi	...	ʒii
		Aquam	...	ad ℥vi
(22)	Re	Hexamine	...	ʒi
		Sodii bicarb.	...	ʒi
		Inf. buchu	...	ad ℥vi

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(23) Re Potass. bromid. ... ℥i
Liq. strych. hydrochlor. ... ℥i
Aquam ... ad ℨvi

(24) Re Quin. bihydrochlor. ... ℥ss
Liq. arsenici hydrochlor. ... ms. xii
Tinct. card. co. ... ℥i
Inf. rhei ... ad ℨvi

(25) Re Calcii chlorid. ... ℥iii
Spt. ammon. aromat. ... ℥ii
Aquam ... ad ℨvi

(26) Re Calcii hypophosphite ... grs.v
Potass. chloras. ... grs. v
M. ft. pulv, one

(27) Re Liq. morphinæ hydrochlor. ℥ii
Liq. atropinæ sulphatis ... ℥ii
Aquam ... ad ℨvi

(28) Re Menthol ... grs. v
Camphor ... grs. v
Chloral hydras. ... grs. v

(29) Re Ext. filicis liq. ... ℥iii
Ol. ricini ... ℥iii
Aquam ... ad ℨvi

(30) Re Caffein. citras ... ℥i
Potass. iodid. ... ℥i
Aquam ... ad ℨvi

(31) Re Sodii bromid. ... ℥i
Chloral hydras. ... ℥i
Ammon. carb. ... ℥ss
Aquam ... ad ℨvi

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(32)	Re	Silver nitrate	...	grs. iii
		Cocainæ hydrochlor.	...	grs. iss
		Aquam	...	ad ʒvi
(33)	Re	Liq. arsenii et hydrarg. iodid.		ʒi
		Liq. strych. hydrochlor.	...	ʒii
		Acid. nitromuriatic dil.	...	ʒi
		Aquam	...	ad ʒvi
(34)	Re	Potass. chloras.	...	grs. x
		Pulv. glycyrrhizæ co.	...	ʒi
		Saccharatum lactis	...	q. s.
(35)	Re	Potass. iodid.	...	ʒss
		Spt. æther. nitrosi	...	ʒii
		Tinct. ferri perchlor.	...	ʒii
		Inf. gentianæ	...	ad ʒvi
(36)	Re	Acid. nitromuriatic dil.	...	ʒi
		Ferri et ammon. citras.	...	ʒss
		Syr. tolu	...	ʒii
		Aquam	...	ad ʒvi
(37)	Re	Ol. ricini	...	ʒi
		Muc. acaciæ	...	q.s.
		Tinct. opii	...	ʒss
		Aquam	...	ad ʒvi
(38)	Re	Quin. sulphas.	...	grs. xx
		Acid. sulphuric dil.	...	ʒi
		Sodii benzoas	...	ʒi
		Syr. limonis	...	ʒii
		Aquam	...	ad ʒvi
(39)	Re	Quin. sulphas.	...	grs. xii
		Acid. hydrobromic dil.	...	ʒss
		Liq. bismuthi	...	ʒiii
		Potass. iodid.	...	ʒss
		Acid. hydrocyanic dil.	...	ms. xv
		Aquam	...	ad ʒvi

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(40)	Re	Acid. carbolic	...	ʒi
		Collodion	...	ad ʒi
(41)	Re	Liq. morphinæ hydrochlor.	...	ʒii
		Tinct. cannabis ind.	...	ʒi
		Muc. acaciæ	...	q.s.
		Aq. laurocerasi	...	ad ʒvi
(42)	Re	Plumbi acetas	...	grs.vi
		Zinci sulphas.	...	grs.vi
		Ext. opii liq.	...	ʒii
		Aq. dest.	...	ad ʒvi
(43)	Re	Ammon. carb.	...	ʒss
		Liq. strych. hydrochlor.	...	ʒss
		Aq. chlorof.	...	ad ʒvi
(44)	Re	Tinct. guaiaci ammon.	...	ʒiii
		Tinct. ferri perchlor.	...	ʒii
		Aquam	...	ad ʒvi
(45)	Re	Sodii salicylas.	...	ʒi
		Liq. ferri perchlor.	...	ʒi
		Aquam	...	ad ʒvi
(46)	Re	Quin. sulphas.	...	grs. xx
		Acid. sulphuric dil.	...	ʒss
		Glycerine	...	ʒii
		Inf. krameriæ	...	ad ʒvi
(47)	Re	Liq. ammon. acet.	...	ʒvi
		Tinct. ferri perchlor.	...	ʒi
		Aquam	...	ad ʒvi
(48)	Re	Morphinæ sulphas.	...	grs.iii
		Tinct. card. co.	...	ʒi
		Tinct. catechu	...	ʒiii
		Aquam	...	ad ʒvi

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(49)	Re	Ferri et quin. cit.	...	ʒi
		Tinct. nucis vom.	...	ʒss
		Ext. glycyrrhizæ liq.	...	ʒiii
		Aquam	...	ad ℥vi
(50)	Re	Potass. permang.	...	grs.x
		Creosote carb.	...	grs.x
		Silver nitrate	...	gr.½
		M. ft. pil.		
(51)	Re	Ammon. benzoas.	...	ʒi
		Acid. sodii phosph.	...	ʒiii
		Aquam	...	ad ℥vi
(52)	Re	Quin. sulphas.	...	grs.xx
		Acid. sulphuric dil.	...	ʒi
		Sodii salicylas.	...	ʒi
		Ferri sulphas.	...	grs.xii
		Syr. rosæ	...	ʒii
		Aquam	...	ad ℥vi
(53)	Re	Quin. sulphas.	...	ʒss
		Acid. sulphuric dil.	...	m.xv
		Potass. acetas.	...	ʒi
		Aquam	...	ad ℥vi
(54)	Re	Liq. ammon. cit.	...	ʒvi
		Spt. ammon. aromat.	...	ʒii
		Tinct. iodi	...	ʒi
		Aquam	...	ad ℥vi
(55)	Re	Chloral hydras.	...	ʒi
		Liq. potassæ	...	ʒii
		Aquam	...	ad ℥vi

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(56) Re Tinct. guaiaci ammon. ... ʒiii
Oxymel scillæ ... ʒiii
Aquam ... ad ʒvi

(57) Re Sodii bicarb. ... ʒii
Spt. ammon. aromat. ... ʒii
Pepsinum ... ʒss
Aquam ... ad ʒvi

(58) Re Liq. bismuthi et ammon. cit. ... ʒiii
Acid. sulphuric dil. ... ʒi
Inf. chirettæ ... ad ʒvi

(59) Re Liq. morphinæ hydrochlor. ... ʒii
Goulard's lotion ... ʒii
Aquam ... ad pint i

(60) Re Pulv. scammoniæ co. ... grs.x
Ferri sulph. ... grs.ii
Glycerine ... q.s
M. ft. pil. i

(61) Re Sodii bicarb. ... ʒi
Pulv. cretæ aromat. ... ʒii
Tinct. opii ... ʒiii
Aq. anethi ... ad ʒvi

(62) Re Salicin ... ʒii
Aquam ... ad ʒvi

(63) Re Potass. bicarb. ... ʒii
Ext. glycyrrhizæ liq. ... ʒiii
Liq. ammon. cit. ... ʒvi
Mag. sulphas. ... ʒiii
Aquam ... ad ʒvi

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(64)	Re	Tinct. iodi	...	ʒi
		Lin. camphoræ ammon.	...	ʒi
		Lin. saponis	...	ʒii
(65)	Re	Sodii bicarb.	...	ɔii
		Spt. ammon. aromat.	...	ɔi
		Salol	...	ɔi
		Aquam	...	ad ʒvi
(66)	Re	Podophyllin	...	gr. ss
		Plumbi acetas.	...	grs. ii
		Ext. gentianæ	...	grs. ii
		M. ft. pil i		
(67)	Re	Sodii bicarb.	...	ɔi
		Sodii phosphas.	...	ɔvi
		Mag. sulphas.	...	ɔvi
		Aquam	...	ad ʒvi
(68)	Re	Sodii benzoas.	...	ɔi
		Tinct. ferri perchlor.	...	ɔi
		Aquam	...	ad ʒvi
(69)	Re	Liq. ammon. acet.	...	ɔvi
		Acid. sulphuric dil.	...	ɔi
		Spt. chlorof.	...	ɔi
		Aquam	...	ad ʒvi
(70)	Re	Ferri sulphas.	...	grs. ii
		Acid. gallic	...	grs. v
		Glycerine	...	q.s.
		M. ft. pil. i		
(71)	Re	Potass. iodid.	...	ɔss
		Hydrarg. perchlor.	...	gr. $\frac{1}{3}$
		Liq. strych. hydrochlor.	...	ɔss
		Aq. chlorof.	...	ad ʒi v

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(72) Re Acid. phosphoric dil. ... ʒi
Tinct. ferri perchlor. ... ʒi
Liq. strychninæ ... m.xviii
Aq. chlorof. ... ad ℥vi

(73) Re Sodii bicarb. ... ʒi
Spt. ammon. aromat. ... ʒii
Liq. calcis ... ad ℥vi

(74) Re Tinct. catechu ... ʒii
Ext. hamamelidis ... ʒii
Liq. morphinæ ... ʒss
Tinct. card. co. ... ʒii
Aquam ... ad ℥vi

(75) Re Liq. ammon. cit. ... ʒiv
Spt. ammon. aromat. ... ʒii
Sodii salicylas. ... ʒii
Aquam ... ad ℥vi

(76) Re Potass. bromid. ... ʒii
Liq. strychninæ ... ʒii
Acid. hydrochlor. dil. ... ʒii
Aquam ... ad ℥vi

(77) Re Tinct. cinchonæ ... ʒii
Sodii salicylas. ... ʒii
Aquam ... ad ℥vi

(78) Re Sulphonal ... grs. x
Chloral hydras. ... grs. x

(79) Re Ext. aloes ... gr. i
Ext. nucis vom. ... gr. $\frac{1}{6}$
Potass. permang. ... gr. i
M. ft. pil. i

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(80)	Re	Tinct. hyoscyamus	...	ʒii
		Liq. potassæ	...	ʒii
		Aquam	...	ad ℥vi
(81)	Re	Tinct. ferri perchlor.	...	ʒii
		Spt. ammon aromat.	...	ʒii
		Aquam	...	ad ℥vi
(82)	Re	Lin. ammoniæ	...	ʒiv
		Lin. camphoræ et ammon.	...	ʒiv
		Lin. terebinthinæ	...	℥i
(83)	Re	Zinci sulphas.	...	grs. x
		Liq. calcis	...	ad ℥i
(84)	Re	Liq. arsenicalis	...	℥i
		Liq. strychninæ	...	℥i
		Tinct. strophanthi	...	ʒiii
		Aquam	...	ad ℥vi
(85)	Se	Morphinæ sulphas.	...	gr.i
		Sodii bicarb.	...	ʒi
		Aq. anethi	...	ad ℥vi
(86)	Se	Potass. permang.	...	gr.i
		Paraffini molle	...	q.s.
		M. ft. pil. i		
(87)	Re	Potass. iodid.	...	ʒi
		Spt ætheris nitrosi	...	ʒii
		Liq. morphinæ	...	℥ss
		Syr. tolu	...	ʒii
		Aquam	...	ad ℥vi
(88)	Re	Ammon. carb.	...	ʒi
		Spt. ammon. aromat.	...	ʒii
		Tinct. scillæ	...	ʒiss
		Aquam	...	ad ℥vi

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(89) Re Sodii salicylas. ... ℥i
Sodii bicarb. ... ℥i
Syr. limonis ... ℥iv
Aquam ... ad ℥vi

(90) Re Ammon. carb. ... ℥ss
Spt. ammon. aromat. ... ℥ii
Tinct. camphoræ co ... ℥ii
Aquam ... ad ℥vi

(91) Re Sodii bicarb. ... ℥ii
Pancreatin ... grs. xii
Liq. pepticus ... ℥vi
Aquam ... ad ℥vi

(92) Re Camphor ... gr. i
Acid. carbolic ... gr. i
M. ft. pil. i

(93) Re Acid. nitromuriatic dil. ... ℥i
Tinct. nucis vom. ... ℥ss
Taka diastase ... ℈ss
Aquam ... ad ℥vi

(94) Re Tinct. cinchonæ co. ... ℥vi
Tinct. ferri perchlor. ... ℥i
Aquam ... ad ℥vi

(95) Re Magnesia pond. ... ℥vi
Sodii bicarb. ... ℥i
Aquam ... ad ℥vi

(96) Re Mag. carb. pond. ... grs. iii
Sodii bicarb. ... grs. v
Pulv. rhei ... gr. v
Ext. gentianæ ... q.s
M. ft. pil. i

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(97) Re Oil. ricini ... ʒiv
Liquid paraffin ... ʒiv

(98) Re Spt. ætheris nitrosi ... ʒii
Phenazone .. ʒi
Aquam ... ad ʒvi

(99) Re Quin. hydrochlor. ... grs. v
Sodii bicarb. ... grs. xx
Aquam ... ad ʒiv.
M. No. 1
Acid. citric ... grs. x
Syr. limonis ... ʒss
Aquam ... ad ʒiv
M. No. 2

Sig. No. 1 is to be mixed with No. 2 before use.

(100) Re Acid chromic ... ʒii
Alcohol ... ʒii
Glycerine ... ʒiv

N.B. Most of the above prescriptions are for six doses of one ounce each.

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ANSWERS TO THE EXERCISES

(1) Bismuth subnitrate being acid in reaction will slowly decompose the alkaline sodium bicarbonate and spt. ammon. aromat., liberating CO_2 gas. The bottle may burst after being put aside for some time.

(2) Syrup ferri iodide being acid in reaction is incompatible with the alkaline liquor arsenicalis and ferrous carbonate will be precipitated. The quantity of gum is also not sufficient to emulsify the codliver oil. Atleast 3 drams of gum should have been added.

(3) Lemon syrup contains citric acid, which acts on the sodium nitrite, liberating nitrous acid. This nitrous acid in its turn liberates iodine from the potassium iodide.

(4) Calcium sulphate will be precipitated.

(5) Infusion of roses contains sulphuric acid ; so it is incompatible with the alkaline potassium citrate, and its colour is changed from red to bright green.

(6) After a time the powder decomposes liberating salicylic acid.

(7) If the mixture is dispensed in the order given and hydrarg. perchloride is first mixed with the spirit ammon. aromat. (which contains ammonium carbonate), a precipitate of hydrarg. ammoniata will be formed. If however hydrarg. perchloride be first added to potassium iodide, potassium mercuric iodide will be formed and spt. ammon. aromat. may then be added without any precipitate.

(8) Tinct. cannabis indicæ contains resin which is precipitated by water and bismuth subnitrate is also insoluble in water ; so mucilage of acacia should be used to

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suspend these drugs. This is an example of physical incompatibility.

(9) Potassium permanganate is readily deoxidized in the presence of glycerine which is an organic matter and there is risk of an explosion and so the prescription should not be dispensed. These pills may however be made up with kaolin or paraffin instead of glycerine.

(10) Borax (sodii biborate) being alkaline in reaction the alkaloid cocaine is precipitated as hydrate.

(11) Soluble salts of lead precipitate sulphates. Here alum being a sulphate a precipitate of insoluble lead sulphate is formed. The subacetate of lead will also precipitate the mucilage.

(12) Syrup scillæ contains acetic acid and so when it is mixed with the alkaline ammonium carbonate and potassium bicarbonate, carbonic acid gas is liberated.

(13) Liquor arsenicalis being alkaline is incompatible with hydrarg. perchloride. Mayer's reagent ($HgI_2 2KI$) or potassio-mercuric iodide is formed and precipitates the alkaloids of the cinchona bark.

(14) Insoluble silver chloride is precipitated.

(15) Tincture quininæ ammoniata will precipitate hydrate of quinine when mixed with water.

(16) The alkaline bicarbonate of potassium is incompatible with alum (double sulphate of aluminium) and aluminium hydroxide will be precipitated.

(17) Bismuth subnitrate being acid in reaction acts on the alkaline bicarbonate of sodium liberating CO_2 gas. Bismuth salts should be suspended by means of mucilage

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of tragacanth and not acacia, for with this a compact mass is formed. Tincture catechu contains tannin and is therefore incompatible with bismuth, tannate of bismuth being formed.

(18) Diuretin or sodium theobromine salicylate is decomposed by acids. Tincture ferri perchloride and lemon syrup are both acid in reaction. So theobromine is precipitated and the mixture turns deep violet due to formation of ferric salicylate.

(19) Borax (sodium biborate) being alkaline is incompatible with zinc sulphate, and insoluble borate of zinc is precipitated. Boric acid should be used here instead of borax.

(20) Digitalis and cinchona both contain tannin. When they are mixed with per-salt of iron the mixture becomes inky from the action of the iron on the tannin, tannate of iron being formed.

(21) The mixture will turn green.

(22) The value of hexamine lies in the formalin produced as result of its decomposition in an acid medium. This prescription being alkaline no decomposition of hexamine into formalin will occur.

(23) Potassium bromide is chemically incompatible with strychnine hydrochlor., and strychnine will be precipitated at the bottom of the bottle. They are also physiologically incompatible with each other, the bromide being sedative, while strychnine is a stimulant to the nervous system.

(24) The tannin contained in the infusion rhei will precipitate tannate of quinine.

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(25) Spirit ammon. aromat. contains ammon. carb., and so a precipitate of calcium carbonate will be formed.

(26) The hypophospite when mixed with the chlorate will cause an explosion ; so such a combination should not be dispensed.

(27) Atropine is an antidote to morphine, because it stimulates the respiratory centre, the cerebral convolutions and intestinal peristalsis, which are depressed by morphine. Still these two are usually (as in this case) combined intentionally to counteract some of the undesirable effects that may follow the administration of morphine, such as constipation and cardiac depression. The dose of liq. atropinæ sulph. is excessive, the B. P. dose being ½ to 1 minim only.

(28) These substances will liquefy when mixed together and so cannot be dispensed in the form of a powder.

(29) Water precipitates the resin in the extract of male fern ; so it should be dispensed as an emulsion with mucilage of acacia or with milk. It is well not to use castor oil, for filicic acid which is believed to cause the toxic symptoms being soluble in this oil may be absorbed.

(30) Caffeine citrate easily dissociates in water liberating citric acid, which in its turn acts on the iodide and sets free iodine.

(31) Chloral hydrate is incompatible with the alkaline ammon. carb. and chloroform will be liberated.

(32) Silver nitrate is incompatible with tap water which contains chlorides and so only distilled water should be used. It is also incompatible with cocaine hydrochloride, a white precipitate of silver chloride being formed.

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(33) Liquor arsenii et hydrarg. iodidi is alkaline in reaction and precipitates the alkaloid strychnine. Iodine will also be liberated due to the presence of free acid. Note the overdose of strychnine.

(34) Pulv. glycyrrizæ compound contains sulphur which when rubbed with potassium chlorate and sugar causes explosion.

(35) Tincture ferri perchloride being acid in reaction will liberate iodine from potassium iodide and so will the spirit of nitrous ether if it be acid. Gentian contains no tannin, but still it cannot be prescribed with iron, because that darkens the colouring matter.

(36) Ammonium citrate is decomposed by the acid and ferric citrate is precipitated.

(37) Castor oil is a purgative, while opium is an astringent ; but still they are often given together intentionally in cases of dysentery where opium is used for relieving the griping pain.

(38) There will be two different reactions. Sodium benzoate and sulphuric acid react with one another to form sodium sulphate and benzoic acid which being insoluble in water will be precipitated. By the action of sulphuric acid on quinine sulphate, bisulphate of quinine a soluble salt is formed. As soluble salts of quinine are incompatible with benzoates, benzoate of quinine will be precipitated.

(39) Potassium iodide and liquor bismuthi contained in the prescription react to form double iodide of bismuth and potassium (Dragendorff's reagent), which in its turn precipitates the alkaloid quinine.

(40) Carbolic acid is incompatible with collodion and

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a solid mass will be formed on mixing them. This is an example of physical incompatibility.

(41) Aqua laurocerasi contains 24 minims of hydrocyanic acid per ounce. Here one ounce of aqua laurocerasi has been prescribed for each dose which is excessive and dangerous, as the maximum B. P. dose of hydrocyanic acid is only 5 minims.

(42) Lead acetate forms sulphate of lead with zinc sulphate and meconate of lead with the meconic acid in the opium. These are here intentionally thrown down for their local mechanical action. The bottle should be labelled "Poison for external use only" and also "Shake the bottle."

(43) Ammonium carbonate being alkaline acts on the alkaloid in liquor strychnine which is precipitated. The chloroform may separate and carry poison to the bottom of the bottle.

(44) With tincture guaiaci ammoniata the tincture ferri perchloride solution will change colour becoming blue or even black. Guaiac resin being insoluble in water will be precipitated.

(45) Violet purple colour is produced.

(46) As a result of the interaction of the quinine sulphate with the tannin of the infusion krameriæ, quinine tannate is precipitated.

(47) Ferric hydrate will be thrown down.

(48) Catechu contains tannin ; so tannate of morphine will be thrown down.

(49) The citrate of iron and quinine dissolved in water gives an acid solution and so when it is mixed with the

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extract of liquorice a bulky precipitate of glycyrrhizic acid is formed from the glycyrrhizin.

(50) An explosion will occur.

(51) The *acid* sodium phosphate precipitates benzoic acid from the alkaline ammonium benzoate.

(52) The acid which is added to dissolve the quinine makes the prescription acid in reaction; and sodium salicylate is therefore decomposed, precipitating salicylic acid. The mixture also turns pink due to formation of ferri salicyl.

(53) Quinine being an alkaloid is incompatible with the alkaline potassium acetate and a voluminous precipitate of quinine acetate is thrown down.

(54) With ammonia iodine forms a very dangerous explosive compound—nitrogen iodide.

(55) Chloral hydrate is incompatible with the alkaline liquor potassæ, chloroform being liberated.

(56) The resin in guaiacum is precipitated by water. Ammonia is also incompatible with oxymel scillæ which is acid in reaction. Tincture guaiacum ammoniata should be dispensed in a mixture as an emulsion with mucilage acacia or eggs.

(57) Pepsin does not act in an alkaline medium.

(58) Liquor bismuthi being alkaline is incompatible with the acid, bismuth citrate being precipitated.

(59) There will be precipitates of lead chloride and morphine acetate, the alcohol in liquor plumbi subacetatis being insufficient to dissolve the precipitated morphine.

(60) Pulv. scammoniæ is a purgative and ferri sulphate an astringent; so they are incompatible with one another.

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Glycerine is not a good excipient for the pill and it will be better to use glyc. tragacanth with a little lactose for this purpose.

(61) Pulv. cretæ aromat. being insoluble in water should be suspended by mucilage. There is also overdose of tincture opii.

(62) Salicin is soluble in water in the proportion of 1 to 28. Six ounces of water cannot dissolve more than 102 grains of salicin ; so some of it would remain undissolved. Addition of glycerine to the mixture will help the solution of salicin.

(63) Glycyrrhizin is soluble in alkalies ; but on the addition of magnesium sulphate and ammonia the mixture becomes unsightly.

(64) Tincture iodine forms iodide of nitrogen an explosive compound with ammonia.

(65) Salol which is phenyl salicylate is split up by alkalies into phenol and salicylic acid. It is also insoluble in water.

(66) Podophyllin is purgative and lead acetate an astringent ; so there is therapeutic incompatibility between them.

(67) Magnesium sulphate is incompatible with sodium phosphate producing a thick flocculent precipitate of magnesium phosphate.

(68) With ferric salts an insoluble flesh coloured ferric benzoate is precipitated.

(69) The acid decomposes the alkaline ammonium acetate and smell of acetic acid is given off.

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(70) Ferri sulphate is incompatible with gallic acid. Glycerine is also not a good excipient for ferri sulph., which makes a good pill with glycerine of tragacanth and a little lactose.

(71) When potassium iodide is mixed with mercuric chloride, mercuric iodide is at first precipitated, but is dissolved in the excess of potassium iodide with the formation of potassium mercuric iodide (Mayer's reagent). This double iodide precipitates the alkaloid strychnine from the mixture.

(72) On mixing iron with phosphoric acid, phosphate of iron is formed ; but as it is soluble in the excess of the acid no precipitate will occur. So this prescription is practically not incompatible and is frequently used.

(73) Spirit ammon. aromat. contains ammon. carbonate, which combines with calcium forming precipitate of calcium carbonate.

(74) Both catechu and hamamelidis contain tannin ; so tannate of morphine will be precipitated.

(75) The colour of the mixture will change to brown ; but still this combination is used intentionally.

(76) Potassium bromide will be decomposed by the acid with the liberation of free bromine. The bromide is also chemically and physiologically incompatible with strychnine. Bromide is a spinal sedative and strychnine a convulsant. Two drams of liquor strychninæ in a mixture of six doses mean 20 minims per dose which is excessive and dangerous to life, the B. P. dose being only 2 to 8 minims.

(77) The alkaloid quinine in cinchona combines with the salicylate forming a precipitate of quinine salicylate.

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(78) The powder will become a soft mass.

(79) The pill mass will explode when rubbed together.

(80) Caustic alkalies like liquor potassæ decompose the solanaceous alkaloids and impair or destroy their therapeutic efficacy. The combination of liquor potassæ with tincture hyoscyami is a common error.

(81) Tincture ferri perchloride is acid in reaction and ammonia alkaline ; so the iron will be precipitated as ferric hydroxide.

(82) Liniment terebinthinæ is an acid preparation and the other two alkaline ; so the prescription is chemically incompatible.

(83) There will be a precipitate of calcium oxide.

(84) Liquor arsenicalis being alkaline precipitates the alkaloid strychnine. The doses of liq. arsenicalis, liq. strychninæ and of tinct. strophanthi are excessive.

(85) The alkaloid morphine is precipitated by the alkaline sodium bicarbonate.

(86) It is not possible to prepare this pill with paraffin as it is liable to liquefy. Kaolin may be used to prevent it.

(87) Spirit of nitrous ether if acid will liberate iodine from potassium iodide, The iodide will also precipitate morphine.

(88) Tincture scillæ being acid is incompatible with ammonia.

(89) Lemon syrup being acid is incompatible with the alkaline sodii bicarbonate and also with the salicylate. Salicylic acid is precipitated.

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(90) Ammonium carbonate is a stimulant, while tinct. comphoræ compound is sedative; so the combination is physiologically incompatible.

(91) Liquor pepticus being acid in reaction is incompatible with bicarbonate of sodium. Pancreatin also should not be prescribed with acid solutions.

(92) A soft mass is produced.

(93) Taka diastase should not be given in an acid medium.

(94) As cinchona contains tannin, tannate of iron will be precipitated.

(95) Magnesia being insoluble soon becomes almost a solid mass.

(96) The pill is excessively bulky. No pill should exceed 5 grains in weight.

(97) Oil ricini and liquid paraffin separate into layers after some time, although at first they appear to be miscible.

(98) A brilliant green colour is produced.

(99) This preseription is wrong. An alkaloid such as quinine may be prescribed with an effervescing mixture only if added to the acid portion. The prescription ought to have been written as follows :—

Re

Quinine hydrochlor	...	grs. v
Acid. citric	...	grs. x
Syr. limonis	...	ʒss
Aquam	...	ad ʒiv

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M. No. 1

Sodii bicarb.	...	grs. xx
Aquam	...	ad ʒiv

M. No. 2

Sig. No. 1 is to be mixed with no. 2 and taken during effervescence.

(100) Chromic acid if concentrated will set fire to glycerine and alcohol.

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TABLE OF INCOMPATIBILITIES

Name of the Substance	Incompatible with
Acacia (gum) ...	Alcohol; borax; ferric salts; plumbi subacetatis; sulphuric and nitric acids and guaiacum. For details see p. 90
Acetanilide ...	Antipyrin; chloral hydrate; phenol; salicylic acid (forms pasty mass); spirit ætheris nitrosi (=yellow solution).
Acetates (soluble) ...	Strong mineral acids (liberate acetic acid); aromatic sulphuric acid (sets free acetic ether or ethyl acetate); ferric salts (=red colour); quinine salts (=precipitate quinine acetate).
Acids and acid preparations (see list in p. 13.)	Alkalies and alkaline preparations (see list in p. 13); bromides and iodides; extract glycyrrizæ liq.; organic salts (e.g. benzoates, cinnamates, salicylates etc.); mucilage of acacia. For details see p. 42.
Acid acetic ...	Carbonates and bicarbonates (liberate CO_2); alkalies (form acetates); aromatic sulphuric acid (liberates acetic ether or ethyl acetate).

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Name of the Substance	Incompatible with
Acid acetyl salicylic (aspirin)	Water ; alkalies (see list in p. 13) ; hexamine ; iodides ; quinine solution, For details see p. 87.
Acid arsenious ...	Iron salts (form basic arsenite) ; lime water ; magnesia ; iodide ; tannin.
Acid benzoic ...	See *benzoate*
Acid carbolic ...	See *carbolic acid.*
Acid chromic ...	Alcohol ; glycerine ; volatile oils ; albumin ; organic substances (result in decomposition and explosion).
Acid citricum ...	Acetates ; alkaline carbonates ; potassium tartrate.
Acid gallic ...	Metallic salts generally and especially ferric salts (= blue black colour or precipitate) ; spt. ætheris nitrosi (= red colour with effervescence) ; potassium permanganate (= explosion) ; ammoniated preparations (form yellow or red colour and precipitate) ; alkalies (cause effervescence and colour changes).
Acid hydrochlor. dil. ...	Alkalies and their carbonates ; lead, mercury and silver salts ; potassium chlorate (sets free chlorine).
Acid hydrocyanic dil. ...	Alkalies (except alkaline carbonates and bicarbonates); most metallic salts e.g. iron, lead and silver (= precipitate). For details see p. 44.

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Name of the Substance		Incompatible with
Acids, mineral	...	Alkalies (see list in p. 13); alkaline benzoates, cinnamates and salicylates; bromides; iodides: hyposulphites (set free sulphur); ext. glycyrrizæ liq.; mucilage of acacia.
Acid nitric dil.	...	Alcohol; alkalies and their carbonates; iron sulphate; lead acetate; oxides; adrenaline (is oxidized);
Acid picric	...	Reducing substances (see list in p. 30); alkaloids (= precipitate)
Acid phosphoric dil.	...	Calcium preparations; sodium carbonate.
Acid salicylic	...	Iron salts; quinine sulphate; spirit ætheris nitrosi; spt. ammon. aromat; acetanilide and phenacetin (form paste).
Acid sulphuric dil.	...	Alkalies and their carbonates; lead and calcium salts.
Acid tannic	...	Alkaloids (see p. 52); salts of heavy metals e.g. iron salts (form blue black precipitate); spirit ætheris nitrosi (cause effervescence); potassium permanganate (reduced); phenazone; liquid iodine (decolorised); glucosides (form precipitate) and albumin (form insoluble albumin tannate). For details see p. 64.

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Name of the Substance	Incompatible with
Acid tartaric ...	Alkalies (see p. 3); vegetable astringents; salts of calcium, lead, potassium and mercury.
Adrenaline hydrochlor.	Alkalies (neutralise the acid); nitric and nitrohydrochloric acid (act as oxidizing agents); formalin; hydrogen peroxide; iron salts; oxidizing agents (see list in p. 30). It is safest to prescribe it alone and the only diluent which can be used is saline solution.
Alkalies and alkaline preparations (see list in p. 13).	Acids and acid preparations (see p. 13); salts of alkaloids (precipitate the basic alkaloid); chloral hydrate; iron salts (except the alkaline scale preparations); mercuric chloride. Oils form soap. For details see p. 46.
Alkaloids and their salts	Alkalies (see list in p. 13-14); alkaline benzoates and salicylates; bromides and iodides; liquorice; mercuric chloride; most of the organic acids (except acetic and citric acids); substances cantaining tannin. For details see p. 52.
Alum ...	Alkalies (precipitate aluminium hydroxide); lead acetate (precipitates lead sulphate); tartaric acid (precipitates cream of tartar).

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Name of the Substance		Incompatible with
Ammonii benzoas	...	Acids ; most of the alkaloids; ferric salts ; liquor potassæ ; tartrates.
Ammonii bromide	...	See *bromides.*
Ammonii carbonas.	...	See *alkalies.*
Amylum	...	Iodine and iodides.
Amyl nitrite	...	Alkaline carbonates ; bromides and iodides ; ferrous salts.
Antimony tartrate	...	Alkalies e.g. hydroxides and carbonates (=precipitate of antimony oxide which can be prevented by citrates and tartrates), lime water (precipitates calcium and antimony) ; mineral acids (precipitate the corresponding salt of antimony) ; tannin (precipitates antimony tannate) : lead salts (=precipitate).
Antipyrine	...	See *phenazone.*
Apomorphine	...	See *alkaloids.* Ammonia (forms purple colour) ; iron salts (produce red precipitate, changing to black).
Argenti nitras	...	Alkalies—borax (precipitates silver borate), carbonates and citrates (=ppt.) ; salicylates (=ppt.) ; acids (except acetic and nitric acids) ; astringents containing tannin (precipitate silver tannate) ; bromides and iodides (=ppt.) ; tap water if it contains chlorides (precipitates silver chloride).

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Name of the Substance	Incompatible with
Argyrol ...	Cocaine hydrochlor (precipitates silver chloride); chlorides; zinc sulphate, lead acetate and tannic acid (form ppt.); stains the skin, which may be removed by hydrarg. perchlor. lotion.
Aspirin ...	See *acid acetyl salicylic.*
Atropine	See *Alkaloids.* It is a physiological antidote of morphine and physostigmine. For details see p. 62.
Belladonna	See *atropine.*
Benzoates ...	Mineral acids (liberate benzoic acid as crystals); most of the alkaloids; caffeine citrate solution; ferric salts (form pink precipitate of ferric benzoate); lead, mercury and silver salts (= ppt.).
Betanapthol ...	Camphor; carbolic acid; ferric chloride; menthol; phenazone.
Bicarbonates ...	Acids (= effervescence). Same as carbonates.
Bismuth salicylas ...	Carbonates; iron salts. For details see p. 68.
Bismuthi subnitras ...	Water; alkalies (see list in p. 13); iodides; mucilage of acacia; sulphur (= bismuth sulphide); glycerine (may form nitroglycerine); substances containing tannin (see p. 65). For details see p. 66.

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Name of the Substance		Incompatible with
Borax	...	Alkaloids and their salts; mineral acids (precipitate boric acid); most of the metallic salts (lead, silver, zinc etc.); mucilage of acacia (= ppt.); alum (precipitates aluminium borate). Borax becomes acid on mixing with glycerine.
Bromides	...	Mineral acids; alkaloids; oxidizing agents; calomel; salts of lead and silver. For details see p. 84.
Butyl chloral hydras	...	Alkalies and alkaline preparations (see list in p. 13).
Caffeine	...	Mercuric chloride; tannic acid. [It is not precipitated by the usual alkaloidal reagents e. g. alkalies, bromides and iodides.]
Caffeinæ citras	...	Caffeine citrate when dissolved in water dissociates liberating citric acid and thus forms an acid solution. It is therefore incompatible with alkalies (see p. 13), bromides, iodides, benzoates, salicylates etc., and ext. glycyrrizæ liq. It is also incompatible with salts of mercury and tannic acid.
Calcii carbonate (chalk)	...	Acids (cause effervescence).
Calcium salts	...	Alkaline carbonates; ammoniated preparations; magnesia; oxalates, phosphates and sulphates.

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Name of the Substance		Incompatible with
Calcii hypopospbite	...	Charcoal ; chlorates ; glycerine ; iodine ; nitrates ; sulphur ; permanganate and peroxide ; turpentine. Explodes even when heated or triturated.
Calomel	...	See *hyararg. subchlor.*
Camphor	...	Carbolic acid, chloral hydrate, menthol, naphthol, salicylic acid, salol, and thymol (form liquid).
Cannabis Indica	...	Water.
Carbolic acid	...	Ammonia (forms a colourless solution changing to green and then to blue) ; acetanilide, camphor, chloral hydrate, menthol and phenazone (form liquid with carbolic acid) ; collodion (forms a gelatinous mass) ; copper, mercury and silver salts (are reduced) ; ferric chloride (gives violet colour) ; hydrogen peroxide (oxidizes carbolic acid) ; lead subacetate (produces white precipitate) ; potassium permanganate (oxidizes carbolic acid to oxalic acid and CO_2) ; spt. ætheris nitrosi (produces yellow colour turning to brown); albumin (= coagulation). [Carbonates do not produce effervescence with carbolic acid].

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Name of the Substance		Incompatible with
Carbonates	...	Acids (= effervescence) ; salts of alkaloid (= ppt.) ; bismuth subnitrate (= effervescence) ; metallic salts.
Caryophyllum	...	Lime water ; mineral acids ; salts of iron ; gelatin.
Cascarilla	...	See *tannin containing substances.*
Catechu	...	Do.
Chloral hydratis	...	Alkaline carbonates and hydroxides (liberate chloroform); bromides; iodides; antipyrin ; acetanilide ; carbolic acid (forms liquid) ; alcohol.
Chloramine T.	...	Acids and acid salts ; alcohol ; ammonia and ammon. chloride ; acid boric ; glycerine ; hydrogen peroxide ; metals (so chloramine should not be used to sterilize metal instruments); saccharin; soap; sodium acetate ; sugar.
Cimicifugæ	...	See *tannin containing substances.*
Cinchona	...	As it contains alkaloids (quinine, quinidine etc.), it is incompatible with alkalies etc. (see *alkaloids*). It contains also tannin and so precipitates most metallic salts and gives a blue black colour with salts of iron.
Cinnamoni	...	See *tannin containing substances.*

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Name of the Substance		Incompatible with
Cocaine hydrochlor.	...	See *alkaloids*. Borax (precipitates the hydrochloride as hydrate) ; silver nitrate (precipitates silver chloride) ; carbolic acid solution in water ; mercury ; mercurochrome ; chloroform water (= separation of chloroform, which may be prevented by addition of 5 per cent of alcohol.)
Codeine	...	See *alkaloids*.
Colchici	...	Astringent preparations ; tincture of iodine ; tinct. guaiaci.
Confectio sulphuris	...	As it contains acid potassium tartrate, it is incompatible with grey powder.
Copper sulphate	...	Ammonia and ammon. carb. (produce ppt., which redissolves in excess, producing a deep blue solution) ; borax ; carbonates (precipitate copper carbonate) ; caustic alkalies (precipitate copper hydroxides) ; tannin (precipitates copper salts) ; alkaline phosphates (precipitate copper phosphates) ; iodides (precipitate cuprous iodide and set free iodine).
Creosote	...	Collodion in excess (produces jelly) ; most metallic salts are reduced—lead subacetate (= white ppt.), ferric salts (= blue colour).

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Name of the Substance		Incompatible with
Digitalis	...	Strong alkalies; mineral acids; cinchona (often prescribed intentionally) and other substances containing tannin; iodides; salts of heavy metals e.g. ferric salts (form black colour which may be prevented by citric acid), bismuth, antimony tartrate, lead acetate, salts of gold and silver etc. See p. 65.
Diuretin	...	Acids.
Donovan's solution	...	Acid substances (see p. 13); alkaloids.
Ergot	...	See *tannin containing substances.* [Often prescribed intentionally with perchloride of iron and the resulting inky precipitate is clarified by the addition of citric acid].
Eucalyptus oil	...	Alkaline preparations (see p. 13); mineral acids; mineral salts.
Ferri carb. saccharatus	...	Mineral acids; substances containing tannin; gallic acid.
Ferri et ammon citras	...	Do.
Ferri et quinin. citras.	..	Alkalies (see p. 13); substances containing tannin; gallic acid.

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Name of the Substance	Incompatible with
Ferri perchloride ...	Alkaline hydroxides (precipitate ferric hydroxide); substances containing tannin (precipitate iron tannate or ink); gum acacia (= ppt.); arsenates or arsenites (= ppt.); benzoates (= flesh coloured ppt.); phosphates (precipitate ferric phosphate); hypophosphites (= ppt.); pot. iodide (sets free iodine). Also changes colour with acetanilide in alcoholic solution (= red colour), acetates (blood red), carbolic acid (violet), opium (red), phenacetin (deep red), phanazone (deep red) and salicylates (deep purple colour of ferric salicylate). For details see p. 70
Ferrous sulphate ...	Alkalies (see p. 13); substances containing tannin.
Ferric chloride ...	See *ferri perchloride.*
Formaldehyde (formalin)	Ammonia (forms hexamine); adrenaline; hydrogen peroxide (oxidizes it to formic acid); potassium permanganate (sets free formic aldehyde gas which is used for disinfection of rooms) and other oxidizing agents.
Fowler's solution ...	See *liquor arsenicalis.*
Gallic acid ...	See *acid gallic.*
Gelatin ...	Tannic acid, picric acid and formalin (= ppt.)

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Name of the Substance		Incompatible with
Gentian	...	Iron and lead salts ; silver nitrate. Though it does not contain any tannin, it is not given with iron as it darkens the mixture.
Glucosides	...	Decomposed by mineral acids, alkalies and ferments ; tannic acid (= precipitate) ; lead subacetate (= precipitate).
Glycerine	...	Oxidizing agents (e. g. bichromates, chromic acid, chlorates, nitrates, nitric acid, potassium permanganate etc.) may cause explosion.
Glycyrrhiza	...	Acids and solutions with acid reaction (precipitate glycyrrhizin).
Grey powder	...	See *hydrarg. cum creta.*
Guaiaci resin	...	Mineral acids ; spirit ætheris nitrosi.
Guaiacol	...	Silver oxide.
Hæmatoxyli	...	See *tannin containing substances.*
Hamamelidis	...	Do.
Heroin	...	Same as *alkaloids.* Acids and alkalies decompose it forming morphine.

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Name of the Substance		Incompatible with
Hexamine	...	In solution it is decomposed into formalin to which its therapeutic action depends. Acid sodium phosphate sets free formaldehyde and is therefore prescribed with hexamine. Sodium benzoate and salicylate, salol and antipyrine decompose hexamine. Incompatible also with aspirin (forms liquid).
Hydrarg. ammoniata	...	Lime water (sets free ammonia and forms a yellow salt); iodine (forms an explosive, nitrogen iodide); water.
Hydrarg. cum creta	...	As it contains calcium carbonate (chalk), it is incompatible with acids; confectio sulphuris (which contains cream of tartar or acid potassium tartrate).
Hydrarg. perchlor.	...	Alkalies and alkaline solutions (see p. 13); borax; alkaloids; hypophosphites; iodides; tannin containing substances (see p. 65); lead and silver salts; reduced iron; sulphur and sulphide; albumin; soap. For details see p. 69.

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Name of the Substance		Incompatible with
Hydrarg. subchlor.	...	Alkalies (see p. 13)—lime water (precipitates mercurous oxide or black wash); bromides (form mercuric chloride); iodides, iodoform (decomposed) and tincture of iodine (precipitates mercuric iodide); cocaine (forms mercuric chloride); phenazone (forms mercuric chloride); sulphur and sulphide (form black mercuric sulphide). For details see p. 77.
Hydrastis	...	Alkalies (see p. 13); hydrochloric acid; substances containing tannin.
Hydrogen peroxide	...	As it readily gives off oxygen, it must not be mixed with any oxidizable substance (e. g. carbolic acid, charcoal, glycerine, potassium permanganate sulphur, turpentine etc.). Also incompatible with formaline and lime water.
Hyoscyamine	...	Same as *alkaloids*, with the exception that it may be given with the alkaline bicarbonates.
Hyoscyamus	...	Alkalies (see p. 13); vegetable acids; lead acetate; silver nitrate.
Hypophosphite	...	Oxidizing agents (see p. 30).

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Name of the Substance		Incompatible with
Ichthyol	...	Acid substances (precipitate sulpho-ichthyolic acid); alkaloids (= double decomposition); alkalies (set free ammonia); alum (= ppt); bromides and iodides (= ppt.); zinc sulphate (= ppt.). Ichthyol contains sulphur.
Infusions	...	All infusions (except quassia, calumba and chiretta) contain tannin and are therefore incompatible with alkaloids and salts of iron.
Iodides	...	Acids and substances acid in reaction (set free iodine); alkaloids (= ppt.); ammonium chloride (sets free iodine); aspirin; oxidizing agents e.g. hydrogen peroxide (sets free iodine); mercury (forms mercuric iodide); paraldehyde (sets free iodine); spt. ætheris nitrosi, if acid (sets free iodine); tinct. ferri perchlor. (liberates iodine).
Iodine	...	Ammonia (nitrogen iodide may be formed); alkaloids (precipitate hydriodide); alkalies (decolorize iodine); mercury (forms mercuric iodide); oil turpentine (forms explosive compound).

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Name of the Substance		Incompatible with
Iodoform	...	It decomposes on exposure to the sun ; calomel (forms mercuric iodide on exposure to sunlight) ; hydrogen peroxide (sets free iodine if mixed with iodoform in solution) ; potassium chloride and nitrate; silver nitrate (decomposes iodoform).
Ipecacuanha	...	See *tannin containing substances.*
Iron salts	...	Alkalies (see p. 13) ; substances containing tannin ; gallic acid. For details see p. 70.
Kino	...	Mineral acids ; alkalies ; metallic salts, Kino contains tannin.
Krameriæ	..	See *tannin containing substances.*
Laurocerasi	...	See *hydrocyanic acid.*
Lead salts	...	See *plumbi acetas* and *subacetas.*
Lime water	...	See *liq. calcis.*
Liq. ammon. acetas.	...	Acids and substances acid in reaction (see p. 13) ; sodium and potassium carbonate ; lime water ; salts of lead and silver.
Liq. arsenicalis	...	Being alkaline it is incompatible with acid substances (see p. 13), alkaloids, iron salts (except the alkaline scale preparations) and mercuric chloride. For details see p. 78.

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Name of the Substance	Incompatible with
Liq. arsenici hydrochlor.	Being acid in reaction, its incompatibles are same as those of other acid preparations. For details see p. 79.
Liq. ars. et hydrarg. iodid.	See *Donovan's solution.*
Liq. bismuth. et ammon. cit.	Mineral acids; alkaloids; substances containing tannin. For details see p. 67.
Liq. calcis ...	Acids and preparations with acid reaction (see p. 13); metallic salts; antimony tartrate.
Liq. ferri perchlor. ...	See *ferri perchloride.*
Liq. plumbi subacetatis ...	See *plumbi acetas.* It also precipitates mucilage of acacia.
Liq. potassæ ...	See *alkalies.*
Liq. strychninæ hydrochlor.	Same as *alkaloids.*
Magnesii sulphas ...	Alkalies and alkaline carbonates (except potass. or sodii bicarb. and ammon. carb.); phosphates; lead acetate. For details see p. 68.
Menthol ...	Camphor, carbolic acid, chloral hydrate, resorcin and thymol (form a liquid mass). If water is added to alcoholic solution of menthol, the latter will be precipitated as oily drops.

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Name of the Substance		Incompatible with
Mercurochrome	...	Acids; alkaloidal salts (except caffeine, theobromine sodium salicylate and theophylline sodium acetate) ; most of the local anæsthetics e.g cocaine hydrochlor, butyn, stovaine, etc. To remove stains on the skin, use chlorinated soda solution.
Mercury	...	See *hydrargyri.*
Methyl salicylate	...	Same as *salicylates.* Alkaline hydroxides (decompose methyl salicylate) ; ferric salts (give violet colour),
Morphine and its salts	...	Same as *alkaloids.* Alkalies (see p. 13) ; substances containing tannin (see p. 65) ; salts of copper, lead, mercury and zinc ; ferric chloride in neutral solution (gives blue colour changing to green) ; acacia (gives colouration).
Nitroglycerine	...	Alkalies (decompose nitroglycerine and is used to neutralize). It sets free an oily solution which is explosive.
Nux vomica	...	See *strychnine.*
Oils (fixed)	...	Water; alkaline hydroxides (form soap).

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Name of the Substance		Incompatible with
Opium	...	Alkalies and their carbonates (= precipitate of morphine and narcotine); substances containing tannin (see p. 65); perchloride of iron (= deep red colour due to meconic acid); arsenic; metallic salts (salts of copper and lead, zinc acetate, sub acetate of lead, silver nitrate).
Pancreatin	...	Acids and preparations with acid reaction (see p. 13).
Paraldehyde	...	Almond mixture; pot. iodide (sets free iodine).
Pepsin	...	The action of this degestive ferment is inhibited by alcohol (if over 25 per cent), alkalies, hexamin, magnesium sulphate, malt extract and paraldehyde.
Pepsin, liquid prepn. of	...	Same as *pepsin*. Liquid pepsin contains hydrochloric acid and being acid in reaction is also incompatible with alkalies (see list in p. 13), bromides, chlorides and iodides; substances containing tannin.
Phenacetin	...	Carbolic acid and chloral hydrate (form liquid); salicylic acid (forms a paste); spt. ætheris nitrosi (gives yellow colour).

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Name of the Substance		Incompatible with
Phenazone	...	Mineral acids ; spt. ætheris nitrosi (produces a green colour) ; alkalies ; substances containing tannin ; metallic salts—calomel (corrosive sublimate may be formed), ferric chloride (produces a deep red colour); potassium permanganate ; chloral hydrate (forms liquid). Phenazone liquefies when rubbed with carbolic acid, butyl chloral hydrate and piperazine and forms a pasty mass with sodium salicylate.
Phenolphthalein	...	Alkalies (= red colour).
Piperazine	...	Acetanilide, carbolic acid, chloral hydrate, phenacetin and phenazone (form liquid or paste) ; alkaloids (= ppt.); iron salts (= green or brown ppt.) ; spt. ætheris nitrosi (= yellow to green colour).
Plumbi acetas.	...	Hard water, that is water containing calcium carbonate and sulphate (= ppt. of carbonate or sulphate of lead) ; substances containing tannin (= ppt. of tannate of lead) ; opium (= ppt. of meconate of lead, often intentional), though not with morphine ; most alkaloids; sulphur (forms lead sulphide) ; ichthyol

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Name of the Substance		Incompatible with
Plumbi acetas (contd.)	...	(which contains sulphur); benzoates, borates, bromides, carbonates, chlorides, citrates, cyanides, iodides, oxides, phosphates, salicylates, sulphates, sulphides, tannates, tartrates etc. as all the salts of lead, except the acetates and subacetates, are insoluble in water.
Plumbi subacetas.	...	Same as *plumbi acetas.* Gum acacia and carbolic acid give precipitate with it, but not with lead acetate.
Potass. acetas.	...	See *alkalies.*
Potass. bromid.	...	See *bromides.*
Potass. chloras.	...	Oxidizable substances e. g. charcoal, glycerine, sugar, sulphur etc. (see p. 30); substances containing tannin; antimony; ammonium chloride; hydrochloric acid (sets free chlorine gas).
Potass. iodid.	...	See *iodides.*
Potass. permanganas.	...	Oxidizable substances e.g. carbolic acid, charcoal, glycerine, iodine, sulphur, turpentine and organic compounds like alcohol, oils, sugar etc. (see list p. 30) It is best prescribed alone and when ordered in pills use kaoline as excipient.

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Name of the Substance		Incompatible with
Protargol	...	Same as *argyrol*. Incompatible also with alkaloids and pot. permanganate.
Pulv glycyrrhizæ co.	...	It contains sulphur and sugar; and cause explosion if mixed with pot. chlorate.
Quinine and its salts	...	Same as *alkaloids*. Alkalies (see p. 13); benzoates, salicylates and tartrates; astringents containing tannin (see p. 65); iodides; mercuric chloride; picric acid (precipitates quinine). Quinine is intentionally prescribed with dilute hydrobromic acid to prevent cinchonism. For details see p. 60.
Resorcin	...	Alkaline solutions (discolour); acetanilide, camphor, carbolic acid, menthol etc. (form paste); quinine sulphate (=ppt.); spt. ætheris nitrosi (gives red colour).
Rhubarb	...	*See tannin containing substances.*
Rose, infusum acidum	...	As it contains sulphuric acid and is acid in reaction, it is incompatible with alkalies (forms green colour).
Salicylates	...	See *sodii salicylate.*

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Name of the Substance		Incompatible with
Salol	...	It is insoluble in water; forms paste with camphor, carbolic acid, chloral hydrate, phenazone etc. Alcoholic solutions of salol have all the incompatibles of salicylates.
Silver nitrate	...	See *argentii nitras.*
Sodii benzoas.	...	See *alkalies.*
Sodii biboras	...	See *borax.*
Sodii bicarbonas.	...	See *alkalies.*
Sodii bromid.	...	See *bromides.*
Sodii salicylas.	...	Acid solutions (precipitate salicylic acid); ferric salts; iodides; alkaloids (=ppt.); spt. ætheris nitrosi (produces a yellow colour changing to red); acetanilide; phenacetin; phenazone.
Sodii sulphocarbolas.	...	Ferric salts.
Sodii thiosulphas.	...	Acids (precipitate sulphur and set free sulphur dioxide gas); oxidizing agents (cause explosion); salts of silver and mercury (are reduced).

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Name of the Substance		Incompatible with
Spt. ætheris nitrosi	...	It becomes acid in presence of moisture and is then incompatible with alkalies and alkaline substances (see p. 13) ; tannic acid (forms an explosive) and astringent drugs containing tannin (see p. 65) ; bromides ; iodides (set free iodine) ; salicylates (give yellow to red colour. It also produces colour changes with acetanilide (=yellow), antipyrin (=green), guaiac (=blue to red), morphine (=yellow), phenol (=yellow to red), resorcin (=dark red). For details see p. 88.
Spt. ammon. aromat.	...	Acids and acid preparations (see p. 13) ; inf. rose (forms green colour) ; alkaloids (=ppt.) ; calcium chloride (precipitates calcium hydroxide); chloral hydrate (sets free chloroform); copper, iron and ferric salts (form precipitate of hydroxide) ; iodine (forms nitrogen iodide, an explosive); oils (form soap).
Stovaine	...	Alkalies (see list in p. 13).
Stramonium	...	Caustic alkalies ; mineral acids ; metallic salts.
Strychnine	...	See *Alkaloids*.

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Name of the Substance		Incompatible with
Sugar	...	Oxidizing agents.
Sulphonal	...	Chloral hydrate (= liquefaction).
Sulphur	...	Oxidizing agents (see list in p. 30); heavy metals e. g. lead, mercury etc. (form sulphides).
Syrup ferri iodid.	...	Same as *ferrous sulphate*. Pot chlorate sets free iodine.
Syrup limonis	...	Alkalies and alkaline preparations (see list in p. 13).
Syrup scillæ	...	Alkalies and alkaline preparations (see list in p. 13).
Tannin containing substances	...	Alkalies (see list in p. 13); alkaloids (precipitate tannate); albumin (precipitates albumin tannate); glucosides (= ppt.) iron salts (= blue black ppt.); liquid iodine (decolorized); phenazone; pot. permanganate (is reduced); spt.ætheris nitrosi (= effervescence). For details see p. 65.
Thymol	...	Acetanilide, camphor, carbolic acid, chloral hydrate, menthol, phenazone and salol (form liquid).
Tinct. ferri perchloride	...	See *ferri perchloride*.

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Name of the Substance		Incompatible with
Tinct. quininæ ammoniata		Incompatibles same as those of spt. ammon. aromat. When mixed with water, quinine separates as a milky suspension. It may however be given with ærated water, with which a clear solution forms due to formation of soluble carbonate.
Uva ursi	...	See *tannin containing substances.*
Zinci acetas.	...	Same as those of *zinc sulphate.*
Zinci chloride	...	It is soluble in water; but in dilute solution a flocculent precipitate of hydroxy chloride is produced, which is dissolved if a few drops of dilute hydrochloric acid is added.
Zinci sulphas.	...	Alkalies and alkaline preparations, carbonates, hydroxides and phosphates and borax; astringent vegetable infusions or decoctions containing tannin (see p. 65); lead acetate (precipitates lead sulphate); silver nitrate; milk.
Zinci valerianas.	...	Acids (precipitate valerianic acids); vegetable astringents; soluble carbonates; metallic salts.

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INDEX

A

Acaciæ **90**, 117
and acids 44
alcohol 5, 90
bismuth subnitras 67
borax 51
emulsions 10
Acetanilide 9, 81, 85, 86, 90, **117**
Acetates **3**, 5, 117
and ferric chloride 15, 74
Acetyl-salic. acid **87**, 118
and hexamine 8, 88
,, iodides 27, 83, 87
,, quinine 61, 88
Solubility of 3, 5
Acetphenetidin. See Phenacetin
Acids **42**, 72, 117
and alkalies 12, 46
alkaline salicylates 80
bromides 44
ext. glycyrrhizæ liq. 44
iodides 43, 82
liq. arsenicalis 78
mucilage acacia 44
Acid Acetic 59, 117
Acetyl salicylic See before
Arsenious **3**, **78**, 118
Benzoic 5
Boric 3
Carbolic 3, 5, 6, 7, 8, 15, 74, 86, 90, 118, 124.
Acid Chromic 5, 32, 118
Citric 59, 118
Gallic 72, 118
Hydrobromic 61
Hydrochlor. dil 18, 111, 118
Hydrocyanic dil 11, 13, **44**, 118
Mineral 13, 42, 64, 67, 84, 119
Nitric 24, 33, 119
Phosphoric 18, 119
Picric 5, 61, 119
Salicylic 5, 8, 119
Sulphuric 67, 80, 91, 119
Tannic 31, 56, **64**, 119
Tartaric **120**
Acid preparations, list of 13
Aconite and Digitalis 36
Adrenaline **120**
and amyl nitrite 38
Albumin 5, 64, 77
Alcohol
and acaciæ 5, 90
as solvent **4**
Alkalies 42, **46**, 120
and acids **12**, 42, 46
alkaloids 48, 52
aspirin 87
bismuth subnitras 66
chloral hydras 5, 85
ferric chloride 73
ferrous salts 70
hydrarg. perchlor. 49, 75
mag. sulph. 68

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Alkalies (*Contd*).
and spt. æther. nitrosi 88
,, tannic acid 64
solubility of 3
Alkaline preparations, list of 13
Alkaloids **52**, 120
and alkalies 48, 52
benzoas 55
bromides 58, 84
iodides 57, 83
liq. bismuthi 68
mercury 12, 59, 76, 78
organic acids 59
salicylates 55, 81
tannin 56, 64, 65
list of 52
preparpations of 23
solubility of 3, 52
Alum 9, 26, 51, 120
and borax 47
Ammonia 32, 75
Ammonii Benzoas 12, 24, 55, 121
Bromides See Bromides
Carbonas **50**, 77, 78, 85, 121
Amylum and iodine 121
Amyl Nitrite 33, 37, 38, 121
Answers to Exercises in Incompatibility 105
Antagonism 36
Apparent 38
Real 37
Antifebrin See Acetanilide
Antimony Tartrate 3, 121
Antipyrine See Phenazone
Apomorphine 121
Argentii Nitras See Silver Nitrate
Argyrol See Silver
Arsenates 74
Arsenious Acid 3, **78**
Arsenic, preparations of **78**
Aspirin. See Acetyl salic. Acid
Astringents and purgatives 36
Atropine, incompatibles of 37, 38, 48, **62**, 122

B

Basham's Mixture **48**, 74
Belladonna 122
Benzoates 12, 15, 24, 55, 74, 122
Benzoic Acid 3, 5
Betanapthol 122
Bicarbonates 25, 26, 39, 45, 46, 47, 50, 51, 54, 66, 69, 122
Bichromates and mineral acids 32
Bismuth, liquor **67**
salts, incompatibles of 66
Subnitrate **66**, 83, 122
Salicylate 68, 122
suspension of 67
Black wash 17, 23. **40**, 78
Blaud's pill 21, 71
Borax 6, 9, 51, 123
and acaciæ 51, 90
alkaloids 54
alum 47, 51
chloral hydras 49
glycerine 51
solubility 6
Boric acid 3
Bromides 36, 37, 44, 51, 58, 77, 84, 86, 123
Butyl Chloral Hydras 123

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C

Caffeina 5, **61**, 123
Citras. 24, 80, 123
Calcium
Carbonas 123
Chloride 17, 19, 20, 31
Hydroxide 7, 17, 23
Hypophosphite 31, 124
Lactate 19, 20
salts 126
Calomel See Hydrarg. Subchlor.
Calumba 56
Camphor 5, 8, 86, 124
Cannabis Indica 124
Carbolic Acid 3, 5, 6, 7, 8, 15, 74, 86, 90, 124
and camphor 8
ferric chloride 15
solubility of 6
Carbonates 17, **50**, 68, 125
Carbon dioxide gas
evolution of **24**
Caryophyllum 125
Cascarilla 125
Castor Oil. See Oil Ricini
Catechu 125
Caustic Alkalies 54
Charcoal and Potass. Chlorate 31
Chemical Incompatibility 11
Definition of 1, 11
Heterogeneous 11
Homogeneous 11
Prevention of 35
Varieties 11
Chiretta 56
Chloral Hyrates 5, 8, 32, 49, 84, **85**, 125
and camphor 8
spirit ammon. aromat. 32
sulphonal 8
Chloramine T. 26, 125
Chloride, solubility of 3
formation of precipitate of 17
Chlorine gas, evolution of 26
mixture 40
Chloroform as a solvent 5
and camphor 5
Chromic Acid, exlosive combination 32
Cimicifugæ 125
Cinchona 125
Cinnamomi 125
Cocaine 22, 54, 78, 126
castor oil as solvent 6
and silver nitrate 22
Codeine 126
Colchici 126
Colour, change of 15
Confectio Sulphuris and hydrarg. cum creta 25, 46, 126
Copper Salts 19, 21
Sulphate 21, 126
Corrosive Sublimate. See Hydrarg. Perchlor.
Creosote 126

D

Deliquescent substances 8
Diamorphine, See Heroin
Digitalis 36, **65**, 127
Diuretin 127

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Donovan's Solution, incompatibles of 57, 80, 127
Dragendorff's Reagent 58

E

Effervescing Combinations 39
Emulsions 10
Epinephrine. See Adrenalin.
Ergot 127
Erythrol Tetranitrate, as explosive 28
Eserine, solvent of 6
and atropine 36
Ether, as a solvent 6
Eucalyptus oil 127
Exercises in Incompatibility 92
Explosive Combinations 28
Ext. Glycyrrhizæ Liq. 44

F

Ferri Carbonas Saccharatus 127
Ferri et Ammon. Cit 45,71, 79,82,127
et. Quininæ Cit 53, 56. 57, 65,71, 82, 127
Ferri Perchlor. See Ferric Chloride
Sulphas 128
Ferric Chloride 15, 48, 72, 81,91,128
Ferrum Tartaratum 4, 79, 82
Formaldehyde 128
Formalin 128
Fowler's Solution. See Liq. Arsenicalis

G

Gallic Acid 70, 72, 74, 118, 128
Gas, evolution of 24
Gelatin 128
General Principles 1
Gentian 129
Glauber's Salt and tartaric acid 9
Glonoin. See Nitroglycerin
Glucosides 129
Glycerine 67, 117, 129
and borax 6, 51
carbolic Acid 5
oils 7
as solvent 5
Glyc. Boracis 51
Glycyrrhiza 59, 129
Grey Powder 25, 42, 49, 129
and confectio sulphuris 25,46
Griffith's Mixture 70
Guaiaci Resin 90, 129
and spt. ætheris nitrosi 90
Guaiacol 8, 129
Gums 5
Gum Acacia. See Acacia

H

Hamamelidis 65, 129
Hæmatoxyli 65, 129
Heroin 129
Heterogeneous Incompatibility 11
Hexamine, 8, 88, 130
Homogeneous Incompatibility 11
Hydrarg. Ammoniata 76, 130
Cum Creta 25, 42, 129, 130
Perchlor 75, 130
Subchlor 77, 131
Hydrastis 131
Hydrochloric Acid. See Acid Hydrochlor.
Hydrocyanic Acid 11, 14, 44
Hydrogen Peroxide 26, 32, 131
Hyoscyamina 48, 62, 131

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Hyoscyamus 54, 62, 131
Hypnotics, solubility of 3, 5
Hypophosphites 3, 28, 31, 131

I

Ichthyol 132
Incompatibility, classification of 1
Chemical 1, 11
Definition of 1
Intentional 38
Physical 2
Physiological 36
Inflammable Combinations 28
Infusions 132
Inf. Rose and Alkalies 16, 42
Insoluble Salts 2
Intentional Incompatibility 38
Iodides **82**, 132
and alkaloids 57
chloral hydrate **84**, 86
mercury 23, 76, 78, 79
acids 27, 43, 82
double 57, 61
incompatibles of 27
Quin. and Bismuth 58
Potassio-Mercuric 58
solubility of 3
Iodine, evolution of **27**, 82, 132
and alkaloids 57
ammonia 32
oil turpentine 32
potass. iodid. 6
explosive combinations 32
solubility of 3, 6
tincture and hydrarg.
subchlor 78
pot. chloras 33
Iodoform 133
Ipecacuanha 133
Iron Perchloride 15,48,68,74,81,91
and potass. chlorate 33
Iron Salts, incompatibles of 15,19,21,48,**70**,77,79,133
and acacia 91
acetates 48, 74
alkalies **73**
bismuth salicylate 68
salicylates 74, 81
tannin 65, 72
colour reactions 15, 74
scale preparations of 71, 131

K

Kino 133
Krameria 56, 133

L

Laurocerasi Aquam 133
Lead Acetate 9, 21, 69, 91
Salts 21, 77, 133, 137
Subacetates 17, 21, 91, 138
Lime Water 133
and liq. plumbi subacet. 17
mercury 24
sugar 7
Liq. Ammon. Acet. 133
and pot. carb. 50
Arsenicalis 4, 49, 53, **78**, 133
Arsenici Hydrochlor. **79**, 134
Ars. Hydrarg. Iodid. **80**, 134
Bismuthi et Am. Cit **67**, 134
Calcis 134
Calcis Saccharatus 6
Donovan's 57,80

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Liq. Ferri Perchlor. 73, 134
Plumbi Subacet. 17, 21, 91, 134
Potassæ 134
Strychninæ Hydrochor 134
Liquorice. See Glycyrrhiza
Lotio Hydrarg. Flava 17, 23, 40, 75
,, Nigra 17, 40

M

Magnesium Salts, precipitate of 19,20,
Sulphate 4, 20, 68, 134
Mannitol Hexanitrate 28
Mayer's Reagent 57
Menthol 134
and camphor 8
salol 8
Mercuric Chloride. See Hydrarg Perchlor
Mercurochrome 135
Mercurous Chloride. See Hydrarg. Subchlor.
Mercury, Ammoniated. See Hydrarg. Ammon.
Oxide 22
Perchloride 75, 130
and alkaloids 59, 76
alkalies 75
ammonia 75
bromides 77
hydrocyanic acid 44
lime 17, 23, 40
liq. arsenicalis 49, 79
tap water 4
Mercury Subchloride
and bromide 85
iodide 84
lime 17, 23, 40
sodi bicarb. 78
Mercury Salts 19, 22
Methyl Salicylate 5, 135
Mist. Ferri Ammoniata 73
Compcsita 17, 70
Sennæ Co. 69
Molecular Change 8
Morphine 38, 45, 56, 62, 90, 135

N

Nitrates, solubility of 3
Nitric Acid 24, 33
Nitroglycerine 28, 135
Nuxvomica 135

O

Oils 135
and alkalies 49
glycerine 7
solubility of 7
suspension as emulsion 10
Ol. Olive as solvent 6
Ricini 10
as solvent 6
Paraffin Liq. 6, 7
Opium 136
Organic Acids and Alkaloids 59
Oxidation 29
Oxides, precipitation of 17
Oxidisable Agents 30
Oxidising Agents 30, 83, 85
Oxymel Scillæ 25
Oxygen Gas, evolution of 26

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P

Pancreatin 136
Paraffin Liquid 6, 7
Paraldehyde 84, 136
Pepsin 136
liquid preparations of 136
Pharmaceutical Incompatibility 2
Phenacetin 5, 8, 15, 74, 81, 136
Phenazone 5, 8, 15, 74, 137
and chloral hydras 86
ferric chloride 15, 74
salicylate 8
spt. aetheris nitrosi 16, 90
liquid combinations 8, 9
solubility 3
Phenol. See Carbolic acid
Phenolphthalein 137
Phenyl Salicylate. See Salol
Phosphates 74
Physical Incompatibility 2
Definition of 1
Prevention of 9
Physiological Incompatibility 36
Definition of 1
Physostigmine and Atropine 63
Picric Acid 29, 61
explosive reactions 29
Pilocarpine and Atropine 37, 63
Pilula Ferri 71
Piperazine 137
Plumbi Acetatis 9, 21, 69, 137
Subacetatis 138
Potassium Acetatis 53, 138
Bromides. See Bromides
Chlorate 138
explosive nature of 29
Pot. Chlorate and acids 26
alum 26
amyl nitrite 33
astringents 31
cal. chloride 31
hypophosphites 31
organic drugs 31
sugar 31
sulphur 31
syr. ferri iodide 27
tr. ferri perchlor 33
iodi 33
Citrate 9
Potassium Iodide **82**, 132, 138
and acids 27
aspirin 27
bismuth subnitras 27
calomel 84
spt. nitrous ether 27, 89
liberation of iodine from 27, 82
Pot. Permanganate 3, 26 34, 87, 138
Precipitation 16
Protargol 139
Pulv. Glycyrrhizæ Comp. 139

Q

Quassia 56
Quinine **60**
and aspirin 88
alkalies 48
salts 23, 52, 53, 55, 57, 58, 60, 79, 83, 88, 139

R

Reducing Agents 29
Resorcin 5, 16, 90, 139

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Rhei 56, 139
Roses, Infusion 16, 139

S

Salicylates 15, 24, 43, 55, 74, 80, 89, 139, 140
and acids 24
alkaloids
caffeine citras 24
iron salts 15
phenazone 8
spt. nitrous ether 15
Salicylic Acid 8, 80
Salol 8, 15, 140
Seidlitz Powder 39
Silver Nitras 18, 21, 34, 121, 140
organic compounds of 3
Oxide 34
salts, incompatibles of 19, 77
Sodium Acid Phosphate 130
Arsenas 53
Benzoas 140
and nitric acid 24
Biboras. See Borax.
Bicarbonas 39, 43, 45, **50**, 66, 68, 69, 78, 140
and bismuth salts 66
calomel 78
Bromide. See Bromide
Citro-tartras Efferv. 39
Phosphas and Mag. Sulph. 69
Salicylates. See Salicylate
Sulphas and pot. citrate 9
Sulphocarbolas 140
Thiosulphates 140
Solvents 2
deficiency in 7
Spt. Ætheris Nitrosi **88**, 141
and alkalies 88
antipyrin 16, 90
acetanilide 90
astringent drugs 34
carbolic acid 90
guaiaci 90
iodides 27, 76, 82, 89
mag. sulph. 4
morphine 90
mist. amygdalæ 34
resorcin 16
salicylates 16, 81, 89
tannin 34, 64, 89
Spt. Ammon. Aromat 141
Stovaine 141
Stramonium 141
Strontium Bromide 51
Strychnine. See Alkaloids
and bromides 36, 37
tannic acid 64
Sugar 31, 142
Sulphates, precipitation of 18
Sulphonal and chloral hydrate 8, 86, 142
Sulphur 67, 77, 78, 142
and calcium chloride 31
potassium chlorate 31
Syr. Ferri Iodide 71, 142
Limonis 25, 142
Scillæ 13, 25, 46, 142

T

Tannates, precipitation of 18
Tannic Acid 31, 56, **64**, 67, 70, 71, 77, 119
and alkaloids 56

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Tannin, substances containing 31, 41, 56, **65**, 89, 142
Tartaric Acid 9
Therapeutic Incompatibility 36
Thymol 142
Tinct. Card. Co. and tap water 4
Digitalis 56, **65**, 127
Ferri Perchlor. See Ferric Chloride
Iodine and ammonia 32
pot. chlorate 33
Lavendulæ Co. 4
Opii and ferric chloride 15, 74
Quininæ Ammoniata 56, 143
Tragacanth and Bismuth 67
Trinitrine 28

U

Urotropin. See Hexamine
Unstable Compounds 28
Uva Ursi 143

W

Water, as a solvent 2
Hard 4
Tap 4, 18
White Precipitate 76

Y

Yellow Wash 17, 23, 40, 75

Z

Zinc Chloride 21, 143
Acetate 143
salts 19, 21
Sulphate 51, 143
and calcium hydroxide 17
lead acetate 9
Valerianate 143

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